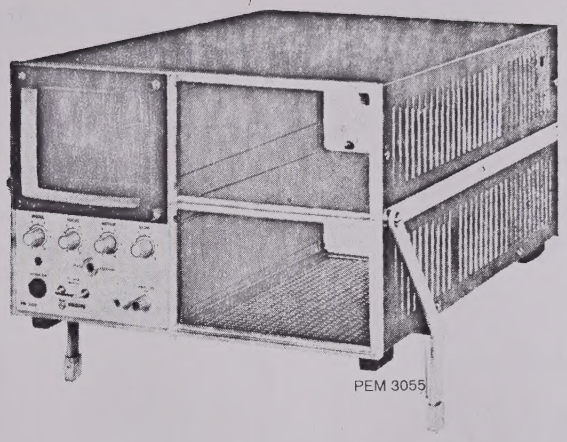

PEM 3055

PHILIPS

*MANUAL*

# BASIC OSCILLOSCOPE PM 3410

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# GENERAL INFORMATION

## *Introduction*

The PM 3410 forms the basic part of the wide band oscilloscope and contains, amongst others, the supply section, the cathode ray tube with square screen, the high voltage unit, the horizontal and vertical output amplifiers and a calibration section. The PM 3410R is identical to the PM 3410, but is adapted for mounting into a 19″ rack.

## *Technical data*

Properties expressed in numerical values with tolerances stated are guaranteed by the factory. Numerical values without tolerances stated represent the properties of an average instrument and merely serve as a guide.

The following data apply in case of nominal mains voltage and an ambient temperature of max. 35 °C, unless otherwise stated.

### A. CATHODE RAY TUBE CIRCUIT

| | |
|---|---|
| Tube | D14–10 GH, with square flat screen.<br>Useful screen area: 100 × 80 mm.<br>Acceleration voltage: 4 kV |
| Unblanking | D.C. coupled |
| Trace rotation | Electrically, by means of a screw-driver adjustment on the front plate |
| Brightness modulation | Required voltage: 30 $V_p$<br>Bandwidth: 40 Hz–1 MHz<br>Input impedance: 10 kΩ//25 pF |
| Measuring graticule | 100 × 80 mm, with X and Y indication on the axes.<br>Intermediate divisions of 2 mm.<br>The graticule illumination is continuously adjustable. |

### B. CALIBRATION SECTION

| | |
|---|---|
| Voltage | Square-wave voltage: 6 $V_{p-p}$, ± 1%<br>Frequency: 1,000 Hz |
| Current | Current bracket through which a square-wave current flows of 6 $mA_{p-p}$, ± 3%<br>Frequency: 1,000 Hz |

### C. SUPPLY

| | |
|---|---|
| Mains voltage | The apparatus is suited for connection to mains voltages of 110, 125, 145, 200, 220 and 245 V.<br>Maximum permissible mains voltage variation ± 10%.<br>Frequency: 50 or 60 Hz |
| Power consumption | Maximum 77 VA (PM 3410 only) |

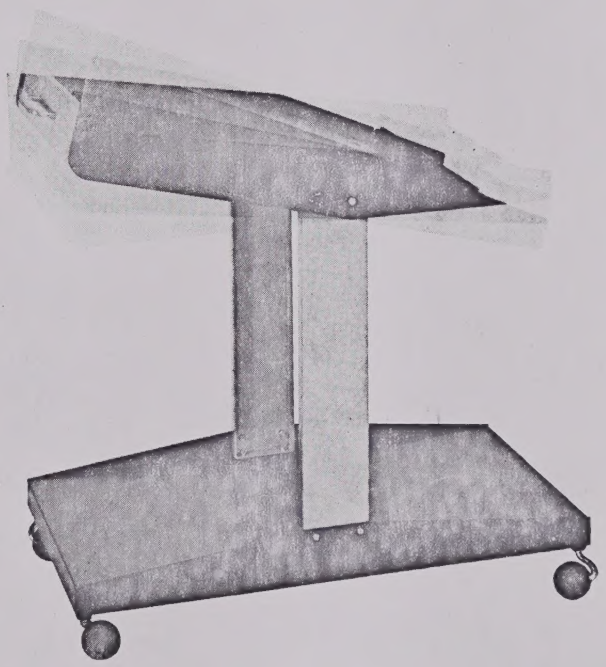
## D. MECHANICAL DATA

| | | |
|---|---|---|
| Dimensions | PM 3410 | Length : 565 mm<br>Width : 350 mm<br>Height : 220 mm |
| | PM 3410 R | Depth : 550 mm (measured from the text plate)<br>Width : 19″<br>Height : 5 units |
| Weight | | 20 kg |

## *Optional accessories*

1.* Test unit for checking and adjusting the PM 3410.
Code number: 4822 395 30015.
2.* Extension print plates for carrying out measurements on the supply panels while the instrument is in operation (see Fig. 1).
Code number: 4822 159 00561 (for units B,C,E,F, G and H)
4822 159 00562 (for unit D)
3. Adaptation set for rack-mounting of the PM 3410
Type number: PM 9349
4. Oscilloscope trolley
Type number: PM 9319
5. Adaptation flange for photographic equipment PM 9300.
Type number: PM 9315

**These items should be ordered from the Central Service Department.*



*Oscilloscope trolley PM 9319*

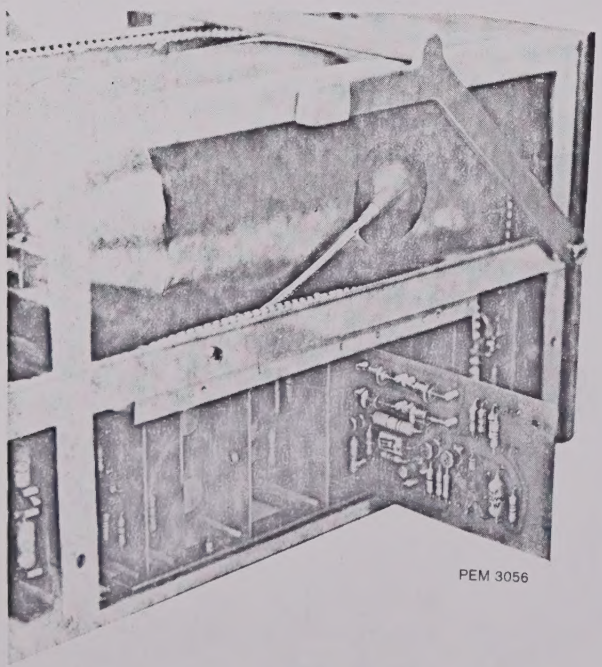



*Fig. 1. Use of extension print plates*

## Block diagram description

The supply section delivers the required voltages and currents for the basic instrument as well as for all plug-in units.
Furthermore, the basic instrument also contains the vertical and the horizontal output amplifier and the E.H.T. supply for the cathode ray tube with, amongst others, the focus and intensity controls.
The unblanking signal ensures the unblanking of the cathode ray tube during the scan of the time base.

The cathode ray tube circuit also contains adjusting facilities for geometry (barrel and cushion distortion), centring of the electron beam and astigmatism.
Brightness modulation can be effected via BU4 ("Z-MOD").

Finally, the calibration section delivers a calibrated voltage to BU1 ("AMPL. CAL") and a calibrated current through the current bracket.

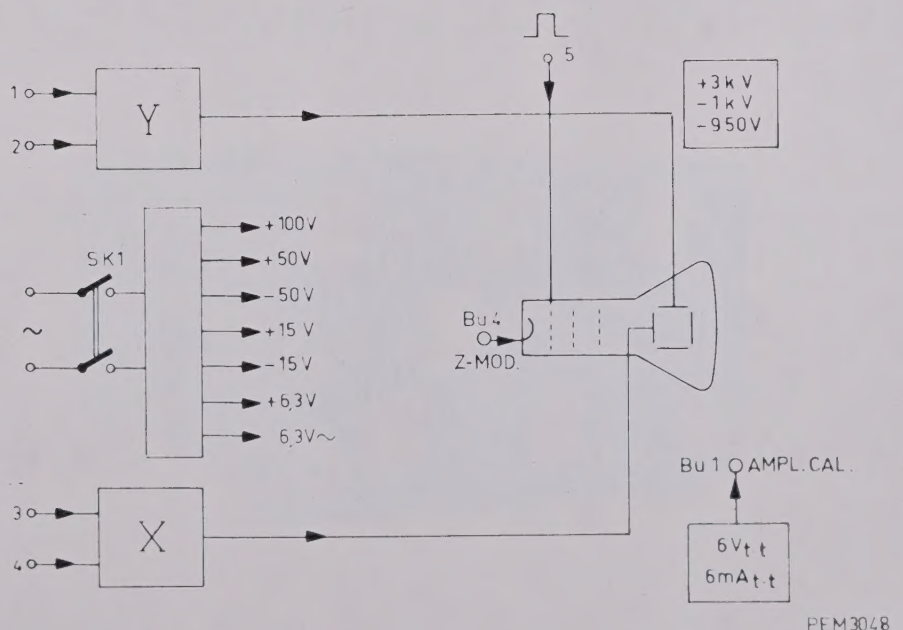



*Fig. 2. Block diagram*

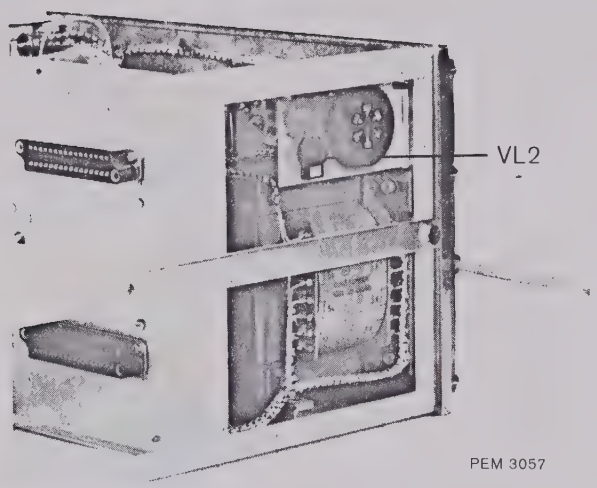



*Fig. 3. Voltage adapter and fuse*

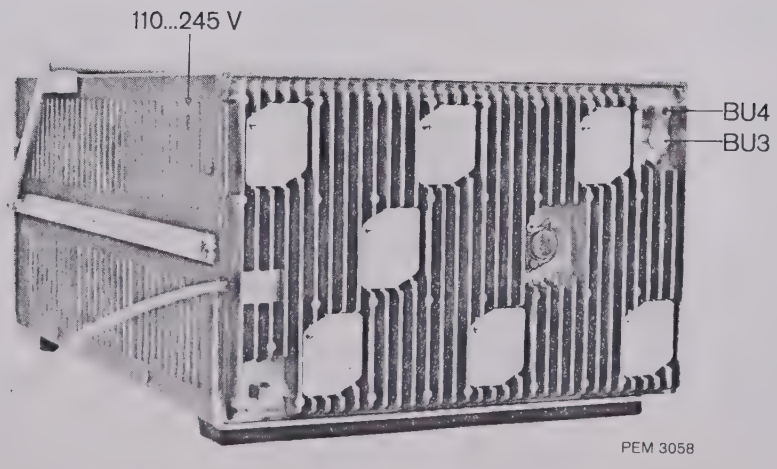



*Fig. 4. Rear view*

# DIRECTIONS FOR USE

## *Installation*

### A. POSITIONING THE INSTRUMENT

Always place the instrument so that the air circulation along the bottom and the rear is not impeded so that proper cooling is ensured. The ambient temperature may not exceed 45 °C.

### B. ADJUSTING TO THE LOCAL MAINS VOLTAGE

The apparatus can be adjusted to mains voltages of 110, 125, 145, 200, 220 and 245 V by means of a voltage adapter.
The set voltage value can be read through the aperture in the right side panel (Fig. 4).
Adjustment to another mains voltage is effected as follows:

- Remove the top plate (see VIII A).
- Pull out the voltage adapter.
- Turn the adapter until the desired voltage is topmost and press it in again.
- Refit the top plate.

**Note:** When used on a mains voltage of 110, 125 or 145 V, fuse VL2 (see Fig. 3) having a value of 1 A should be replaced by a fuse having a value of 2 A.

### C. EARTHING

The apparatus should be earthed in accordance with the local safety regulations. This can be effected as follows:

a. Via the mains flex; the apparatus is provided with a 3-core mains flex.

b. Via one of the earthing sockets BU2 or BU3 (Fig. 5 and Fig. 4 respectively).

AVOID DOUBLE EARTHING!

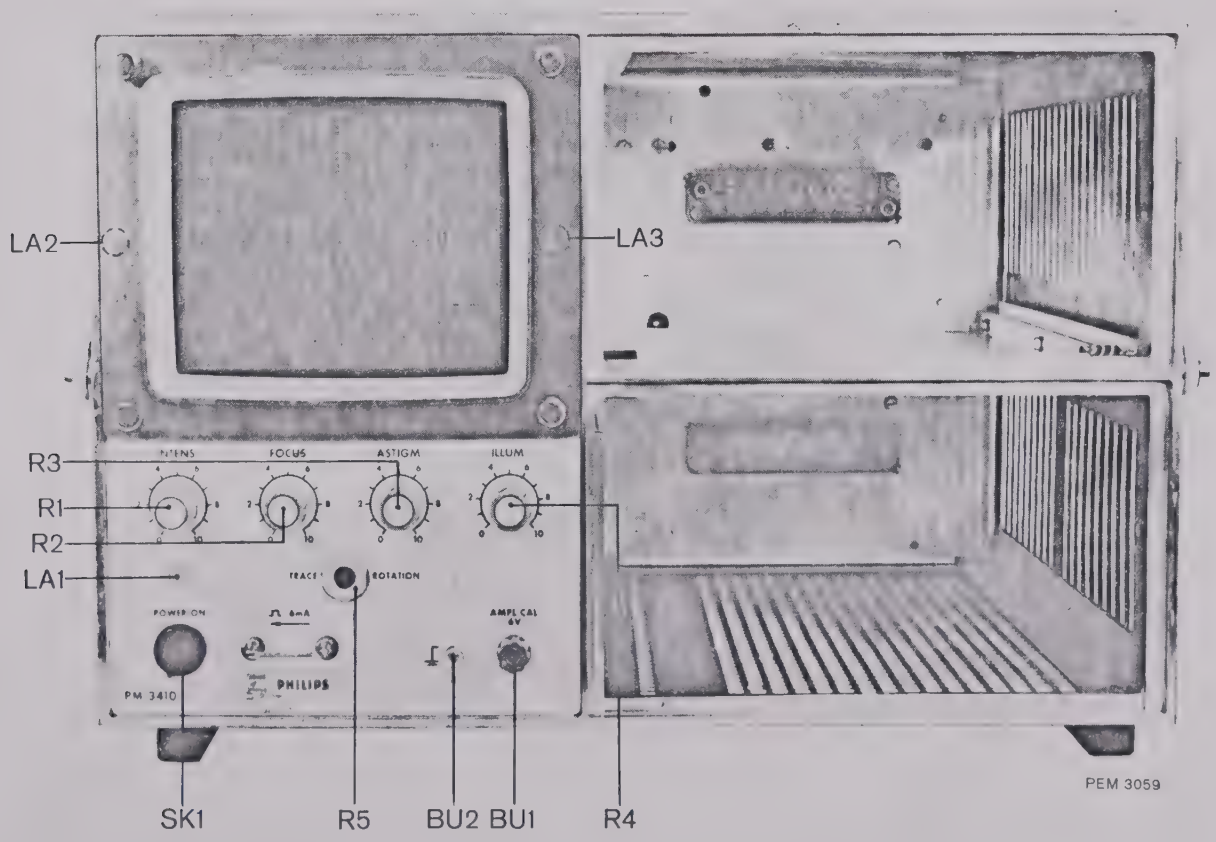



*Fig. 5. Front view*

### D. CONNECTION TO THE MAINS AND SWITCHING ON

- Check that the voltage adapter is in the correct position.
- Earth the apparatus.
- Fit the desired plug-in units.
- Connect the apparatus to the mains.
- Set mains switch SK1 to position "POWER ON".
- Pilot lamp LA1 should light up.

**Remarks:**

- If no Z-modulation is applied it is recommended to interconnect sockets BU4 and BU3 by means of the short-circuiting strip.
- It is recommended to switch off the apparatus when the plug-in units are replaced.

## Operation

Below, a survey is given of the knobs and sockets of the basic instrument (see Fig. 5).

For displaying the signals, refer to the descriptions of the relevant plug-in units.

| | |
|---|---|
| INTENS (R1) | Intensity of the electron beam |
| FOCUS (R2) | Focusing of the electron beam |
| ASTIGM. (R3) | Controls the shape of the spot |
| ILLUM (R4) | Graticule illumination |
| TRACE ROT. (R5) | Rotation of the trace for obtaining a horizontal position |
| POWER ON (SK1, LA1) | Mains switch with pilot lamp |
| AMPL. CAL. (BU1) | Calibration voltage socket |
| CURRENT BRACKET | Calibration current bracket |
| ⏚ (BU2) | Earthing socket |
| Z-MOD (BU4) | Input socket for beam modulation (see Fig. 4) |
| ⏚ (BU3) | Earthing socket (see Fig. 4) |

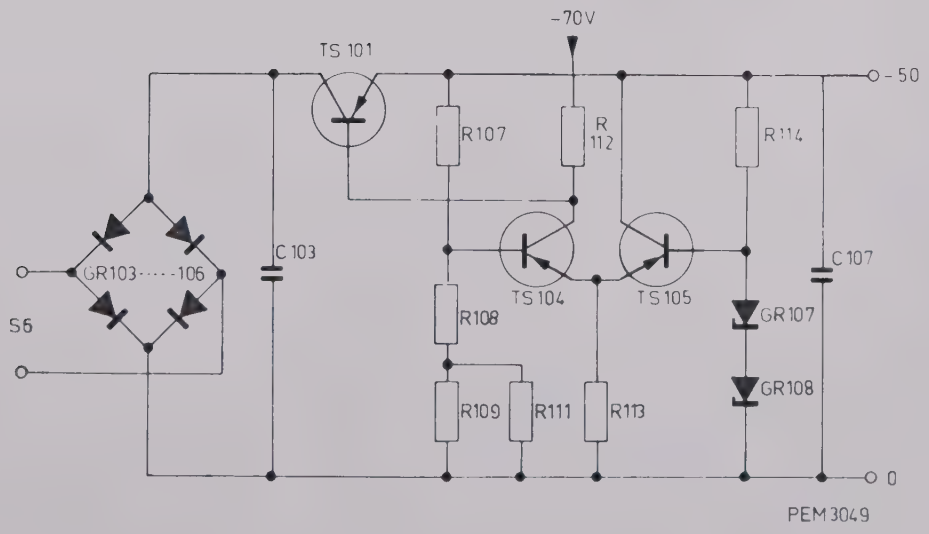



*Fig. 6. Simplified diagram, —50 V unit*

# SERVICE NOTES

## *Circuit diagram description*

The basic oscilloscope consists of the following separate sections.

A. The supply section, delivering d.c. voltages of +50, —50, +15, —15, +100 and +6.3 V.

B. A d.c. amplifier serving as output amplifier for the vertical channel.

C. A d.c. amplifier serving as output amplifier for the horizontal channel.

D. The high voltage supply for the cathode ray tube with controls for focus and intensity.

E. The cathode ray tube circuit with controls for astigmatism, beam centring and geometry. This circuit also includes an input socket for Z-modulation.

F. A calibration section delivering a calibration voltage as well as a calibration current.

The above sections will be described in succession.

### A. SUPPLY SECTION

The supply section consists of various units, all based on the same principle.
Here, the unit delivering a d.c. voltage of —50 V will be described, after which the main deviations of the other supply units with respect to this unit will be given. Fig. 6 shows a simplified diagram.

The voltage, rectified by a Graetz circuit and smoothed by C103, is applied to the output terminals via TS101.
The output voltage is stabilised by comparing the output voltage, via differential amplifier TS104–TS105, with a reference voltage and controlling the current through transistor TS101 with the output voltage of the differential amplifier.
The output voltage of the supply unit, determined by the reference voltage and voltage divider R107–R108-R109// R111, can be accurately adjusted with choice resistors R109 (coarse) and R111 (fine).
So as to make sure that the differential amplifier delivers sufficient amplification, collector resistor R112 is connected to a voltage of —70 V.
This voltage is obtained by adding the output voltage of an additional supply section, consisting of rectifier diode GR101 and Zener diode GR102, to the —50 V voltage (see circuit diagram, Fig. 41).
The circuit diagram of this unit also shows that the control voltage, coming from the collector of TS104, is applied to the base of TS101 via TS102.
TS102 provides an additional current amplification. C104 serves to counteract oscillation phenomena while C106 applies the 100 Hz ripple, produced on account of the full wave rectification, directly to the base of TS104, so that this ripple is reduced considerably by this negative feedback.
The supply unit is protected against overloading (e.g. switching on surges) and short circuiting. The principle of the protection circuit will be explained with the aid of Fig. 7.

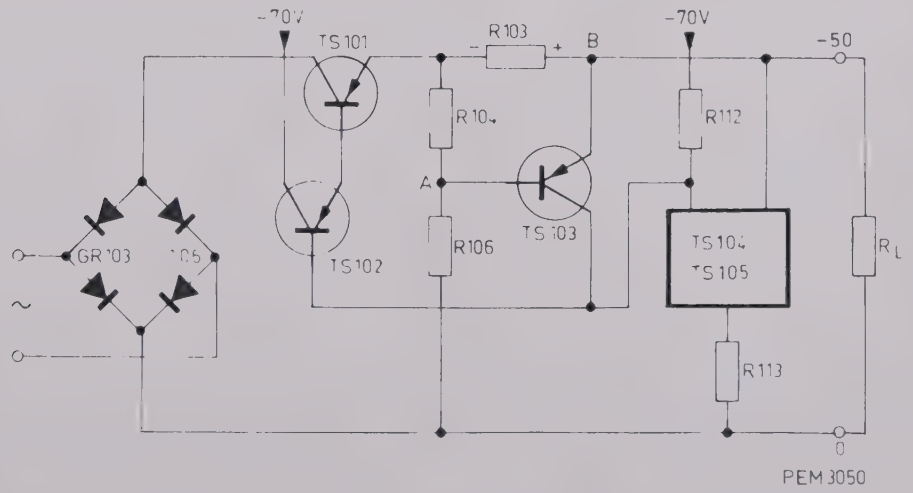



*Fig. 7. Overload protection circuit*

Under normal operating conditions, i.e. at nominal value of load resistor $R_L$, point A is positive with respect to B and transistor TS103 is blocked. The current through series transistor TS101 is therefore determined completely by the output voltage of differential amplifier TS104–TS105.

If the load increases, the voltage drop across R103 wil increase.

The voltage at point A becomes more negative, while the voltage on point B remains practically constant. At a certain value of load resistor $R_L$, the voltage on point A will become so much more negative that TS103 becomes conductive.

The current through TS103 is delivered by the auxiliary voltage as is the case with the base current of TS102.

If $R_L$ continues to decrease, the current through TS103 plus the base current of TS102, at a certain moment, will equal the maximum current that can be delivered by the auxiliary voltage.

In case of a further increase of the overload, the current through TS103 will increase at the cost of the base current of TS102, with the result that also the current through series regulator TS101 decreases.

If a full short circuiting occurs, TS103 will be bottomed and consume a current which is practically equal to the maximum current that can be delivered by the auxiliary voltage. Due to this, the base current of TS102 will be practically zero and series regulator TS101 will be blocked. The voltage across TS101 will then be approximately 50 V.

To prevent TS102 from being subjected to such a voltage, the collector of TS102 is not connected to the collector of TS101 but to the additional voltage of —20 V. In case of a short circuit, the voltage across TS102 can now not exceed 20 V.

The reference voltage, obtained by voltage divider R114–GR107–GR108, is stabilised against temperature variations because diodes having opposite temperature coefficients have been selected for GR107 and GR108.

Also the collector voltage of TS104 (this is the control voltage for the unit) is practically independent from temperature variations due to the application of a "long tailed pair" circuit consisting of silicon transistors TS104–TS105. The leakage currents, occurring in both transistors due to temperature variations, are strongly fed back negatively by the common emitter resistor R113. To improve the temperature stabilisation TS104 and TS105 have been mounted close together on the printed wiring board so that a temperature variation will always occur in both transistors at the same time and to the same extent.

Series transistor TS101 is not mounted on the print plate but on the rear of the instrument, so that proper cooling is ensured.

The built-up of the circuit is such that not the voltage on the output terminals of the supply unit is stabilised but the voltage at the point where the supply is required (see Fig. 8).

A voltage drop across resistors Rp, consisting of wiring resistances and contact resistances, is eliminated

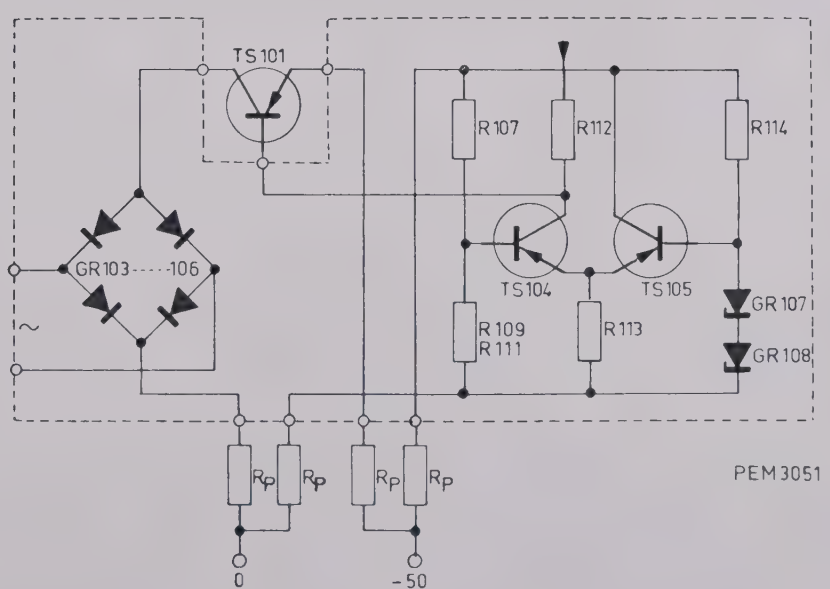



*Fig. 8. Simplified diagram, —50 V unit*

and interference voltages, which may arise in Rp, are stabilised.
The most important deviations of the other supply units with respect to the —50 V unit described above, are the following:

**+100 V unit**

To obtain the reference voltage, Zener diode GR131 and neon tube B101 are used in this unit. The ignition of B101 is effected due to its cathode being connected to the supply voltage of —50 V via GR131 and R168. The noise of B101 is short-circuited by C124.

**+6.3 V unit**

This unit contains an additional emitter follower TS128 so that proper regulation of the large load current is effected.

## B. VERTICAL OUTPUT AMPLIFIER

The output amplifier for vertical deflection is a d.c. coupled push/pull amplifier consisting of cascode stage TS10–TS9 and TS11–TS12.
Resistors R37 and R39 serve to set the desired dissipation of TS10 and TS11 respectively. For high frequencies, these resistors are decoupled by means of capacitors C8 and C11 respectively.
The bases of TS9 and TS12 are connected to a constant d.c. voltage which is stabilised by Zener diodes GR1, GR2 and GR3.
The d.c. level of the output of the amplifier is adjusted with choice resistor R48. The amplification is adjusted with R36.
By means of coils L1 and L2, the rise time of the amplifier is improved.
To protect transistors TS10 and TS11 against an excessive collector voltage in case no d.c. voltage is applied to the input of the amplifier, (no plug-in unit in the vertical channel), the bases of both transistors are connected to the +15 V supply voltage via resistors R33 and R34.

## C. HORIZONTAL OUPUT AMPLIFIER

The output amplifier for the horizontal deflection is a d.c. coupled push/pull amplifier consisting of amplifier stage TS1–TS2, cascode stage TS4–TS3, TS5–TS6 and emitter followers TS7 and TS8.
The amplification of this amplifier can be adjusted with potentiometer R9 while the rise time of the amplifier can be improved with the aid of trimmer C2. With the aid of choice resistor R17, the d.c. level of the output of the amplifier can be adjusted.
Emitter followers TS7 and TS8 reduce the capacitive load on the cascode stage.

## D. E.H.T.

The E.H.T. for the cathode ray tube is generated by an L.C. oscillator consisting of transistor TS15 and circuit S3-Cp (see simplified diagram, Fig. 9).
By means of S2, current feed-back is obtained.
The oscillator frequency is approximately 30 kHz.
The following d.c. voltages are obtained on the secondary side of transformer T2 after rectifying and smoothing:

a. —950 V, which is used as cathode voltage for the cathode ray tube.
b. +3,000 V, which serves for the post-acceleration.
c. Approximately 1,000 V, which serves as voltage for the Wehnelt cylinder of the cathode ray tube.

### a. Cathode voltage

Because the deflection sensitivity is proportional to the acceleration voltage, it is very important to keep this voltage constant. This is effected by stabilising the cathode voltage of the C.R.T. For this, the voltage is fed back to the oscillator via circuit R93, R92, R99, R88, R89, cathode follower B1 and amplifier stage TS16. Cathode follower B1 forms a transition between the high ohmic circuit R93, R92, R99 and the low input resistance of TS16. The —950 V van be adjusted by means of choice resistors R88 and R89 (coarse and fine respectively).
C34 short circuits the ripple of 30 kHz on the grid of B1.
Part of the cathode voltage is applied to the focusing anode (g4) by means of potentiometer R2.

### b. Post-acceleration voltage

The post-acceleration anode is supplied with the voltage of 3,000 V, which is rectified by GR11 and smoothed by R78–C32.
Because the cathode voltage is —1,000 V, the total acceleration voltage is 4 kV.

### c. Intensity control

The voltage on the first grid (Wehnelt cylinder) of the cathode ray tube is determined by the position of potentiometer R1. This voltage is always so that the electron passage to the screen is obstructed.
During the scan of the sawtooth, an unblanking pulse is applied to the emitter follower TS17 via the unblanking amplifier.
From TS17, this pulse is applied (d.c. coupled) to the Wehnelt cylinder of the cathode ray tube, via the floating 1,000 V power supply (see Fig. 10).
The d.c. level of the Wehnelt cylinder consequently rises and the cathode ray tube is unblanked.
The high frequencies of the unblanking pulse are transmitted by C36. The maximum cathode current of the C.R.T. is adjusted with choice resistor R69.

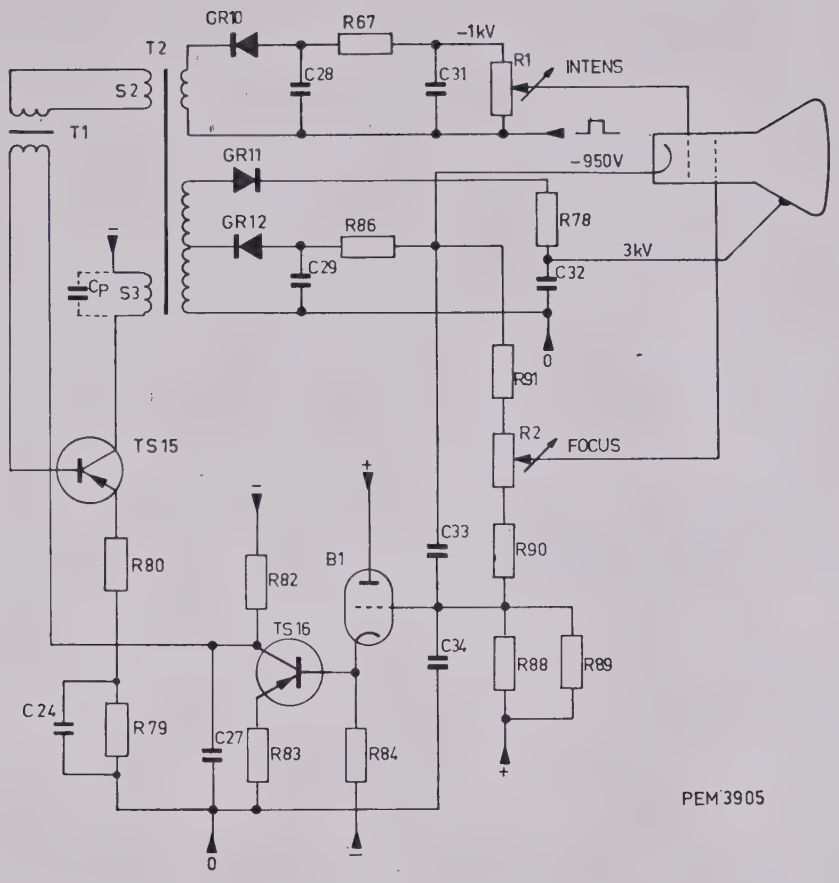



*Fig. 9. Simplified diagram of the high voltage unit*

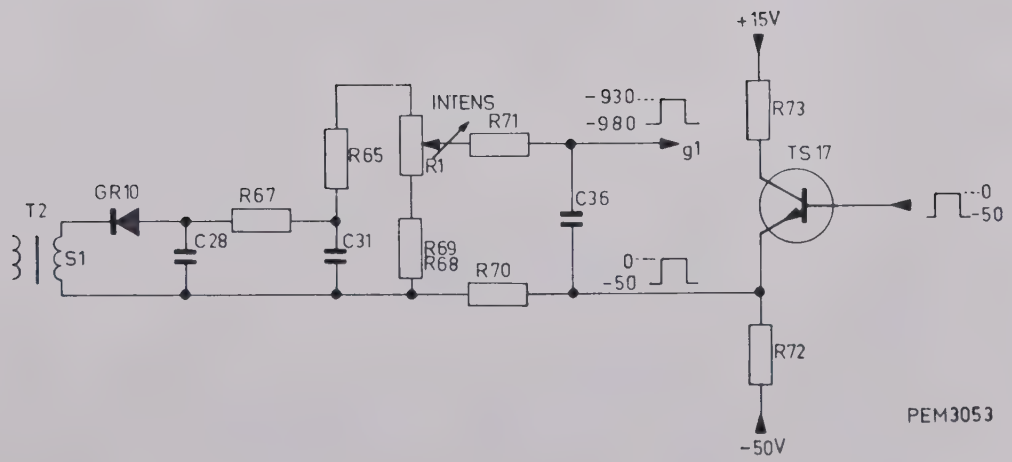



*Fig. 10. Simplified diagram of the 1,000 V supply*

## E. CATHODE RAY TUBE CIRCUIT

L3 is a coil mounted around the cathode ray tube.
A variation of the current through L3 causes a rotation of the trace on the screen. With the aid of R5, by means of which the current through L3 can be varied, the time base line can be adjusted in parallel to the measuring graticule.
The current through coils L4 and L5 can be adjusted with R25.
With the aid of this it can be made sure that the vertical and horizontal deflections are at right angles.
By means of R95, the geometry (barrel and cushion distortion) can be adjusted. R3 serves to adjust the astigmatism and R97 the centring of the electron beam with respect to the deflection system.

To prevent the adjustment of the astigmatism potentiometer from influencing the beam centring, the cursor of R3 is connected to the centre of the Zener diode circuit GR27 . . . GR32.
Fig. 11 clarifies this.

## F. CALIBRATION SECTION

The calibration section consists of an astable multivibrator TS13–TS14 delivering a square-wave voltage of 6 $V_{p\text{-}p}$, having a frequency of 1 kHz, to BU1. The level of the top of the calibration voltage is kept at —0.3 V by means of diodes GR4 and GR5.
The 6 $V_{p\text{-}p}$ square-wave voltage causes a square-wave current of 6 $mA_{p\text{-}p}$ through resistor R62 (1 kΩ) and through the current bracket.
The current bracket is at earth level.
By means of choice capacitor C18 the frequency of the square-wave voltage can be adjusted, while the amplitude can be adjusted with R53 (coarse) and R54 (fine). The symmetry can be adjusted with R56.

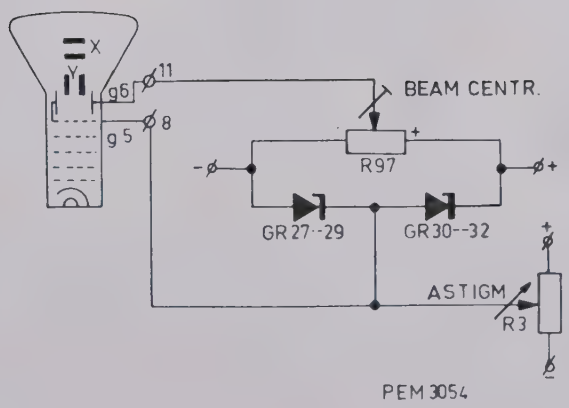



*Fig. 11. Beam centring and astigmatism*

## Gaining access to parts

VIII

### A. REMOVING THE PANELS

**Top plate**
The top plate can be taken off after removing the four fixing screws.

**Side plates**
Each side plate is secured with two screws.

**Bottom plate** (Fig. 12)
The bottom plate can be taken off after the seven screws "A" have been removed and the cable holder has been loosened from its support.

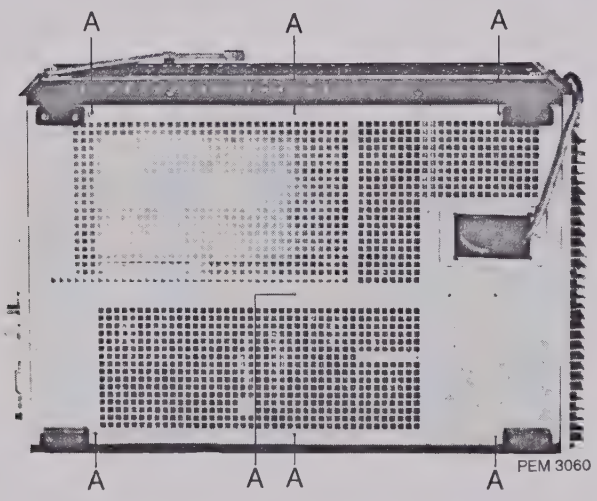



*Fig. 12. Bottom view*

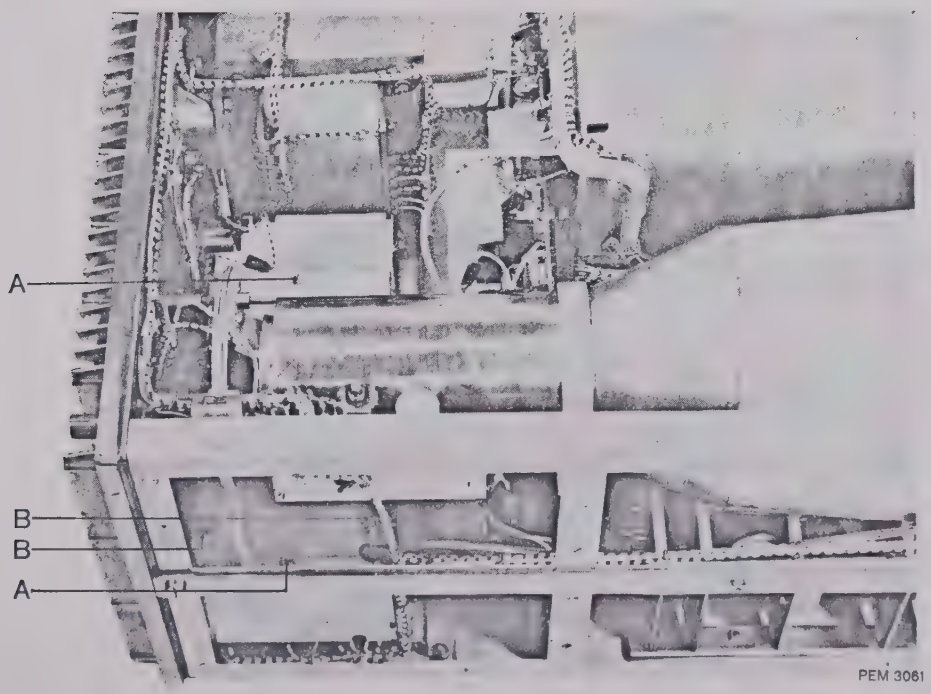



*Fig. 13. Gaining access to the high voltage unit*

## B. GAINING ACCESS TO THE E.H.T. UNIT

- Remove the panelling (see A).
- Remove the two screws "A" and take off the side plates of the E.H.T. unit (see Fig. 13).
- Remove the five screws "B" and take off the top plate of the E.H.T. unit (see Figs. 13 and 14).

If the E.H.T. unit is to be taken out of the instrument, proceed as follows:

- Remove the protective plate (pertinax) at the bottom of the E.H.T. unit.
- Unsolder the electrical connections at the bottom of the unit.
- Detach the E.H.T. cable to the C.R.T.
- Detach the connection wire between the base of the C.R.T. and the E.H.T. unit.

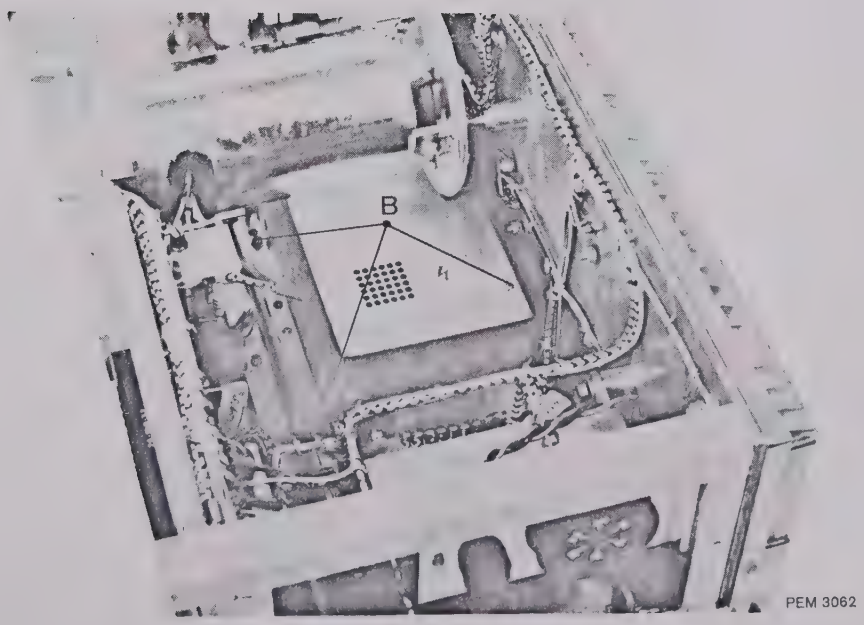



*Fig. 14. Gaining access to the high voltage unit*

– Remove the six screws "C" (Fig. 15).
– The whole unit can then be taken out at the bottom of the instrument.

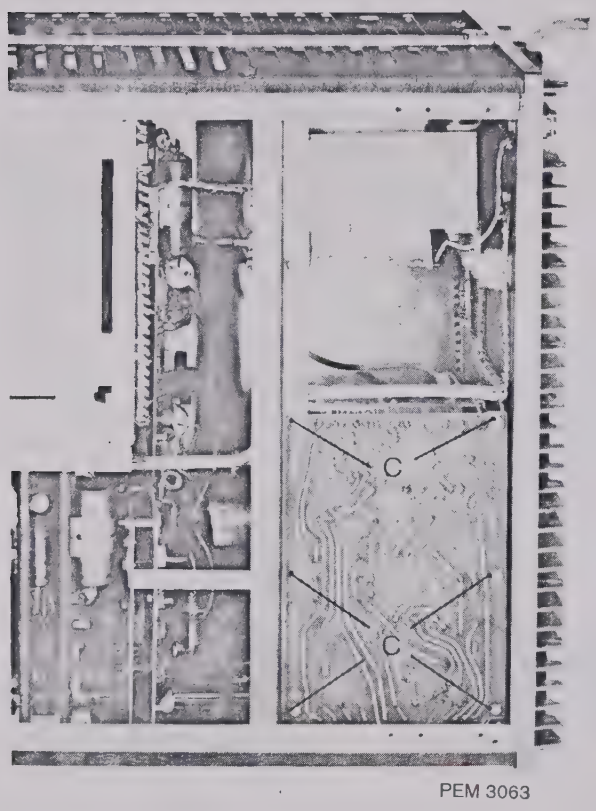



*Fig. 15. Gaining access to the high voltage unit*

**C. REMOVING THE KNOBS** (Fig. 16)

– Remove cap "A" with a pointed knife.
– Loosen nut "B".
– Remove the knob.

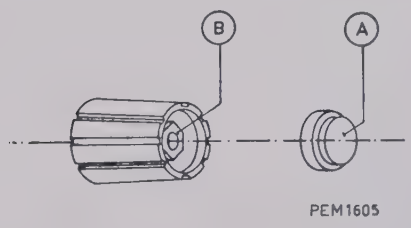



*Fig. 16. Removing the knobs*

**D. REMOVING THE CATHODE RAY TUBE**

– Remove the mask, the measuring graticule and the contrast plate.
– Remove all tube connections, i.e. the E.H.T. connection, the five contacts of the deflection electrodes and the connection plug at the base.
– Detach the four wires of the correction coils L4 and L5 at the side of potentiometer R25.
– Detach the two wires of rotation coil L3 from printed wiring plate unit A.
– Pull the C.R.T. forward out of the instrument.
Mounting the C.R.T. is effected in reverse order.

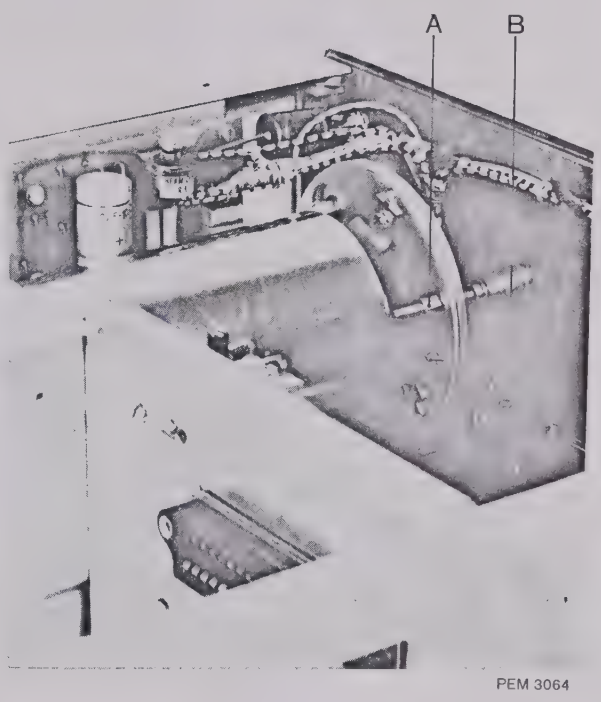



*Fig. 17. Mechanical adjustment of the cathode ray tube*

After fitting the mask, proceed as follows:
– Slide the tube forward in axial direction as far as possible with the aid of the three threaded ends "A" (Fig. 17).
– Loosen screws "B" (Fig. 17) and move the rear of the tube so that the front of the tube is in parallel with the front plate.

**Remark:** Rotation coil L3 is mounted around the neck of the C.R.T. with the aid of a rubber ring. Correction coils L4 and L5 can be mounted only by the factory.

**E. REMOVING THE PRINTED WIRING BOARDS**

**1. Units B...H** (Fig. 18)
– Remove the two screws "R" and with them strip "S".
– The panels can then be pulled out of the instrument.

**2. Unit A** (Fig. 18)
– Remove units B, C and D (see 1).
– Remove cover plate "T".

– Unsolder the soldering connections from the print plate.
– Remove the knobs (see section C).
– Remove the five screws by means of which the print plate is secured to the frame.

**3. Unit K (horizontal amplifier)**

– Detach the two tube connections.
– Detach the soldering connections.
– Remove the three screws "U" (Fig. 18).
– Take out the print plate at the bottom of the instrument.

**4. Unit L (vertical amplifier)**

– Detach the two tube connections.
– Detach the soldering connections from the print plate.
– Unsolder the earthing connection "V" (Fig. 19).
– Remove the four screws "W" (Fig. 19).

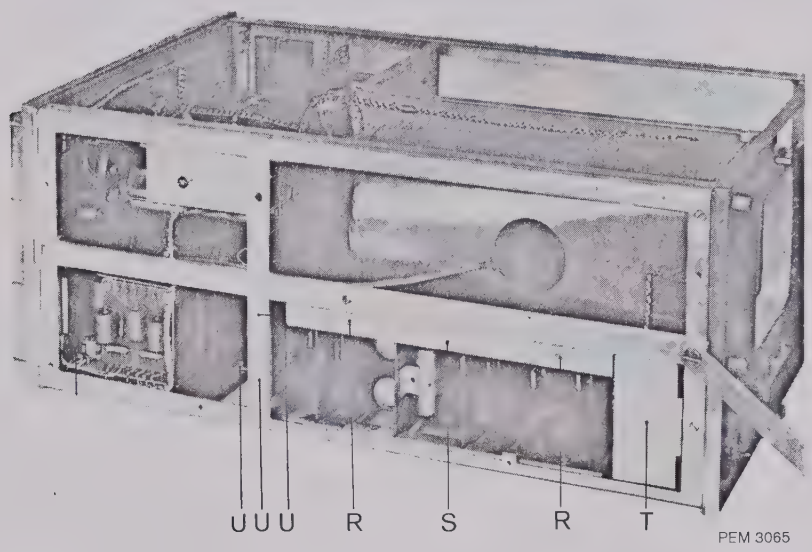



*Fig. 18.*

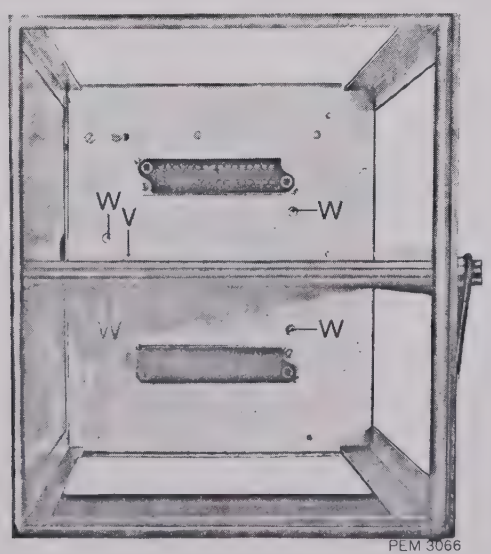



*Fig. 18, 19. Gaining access to the print plates*

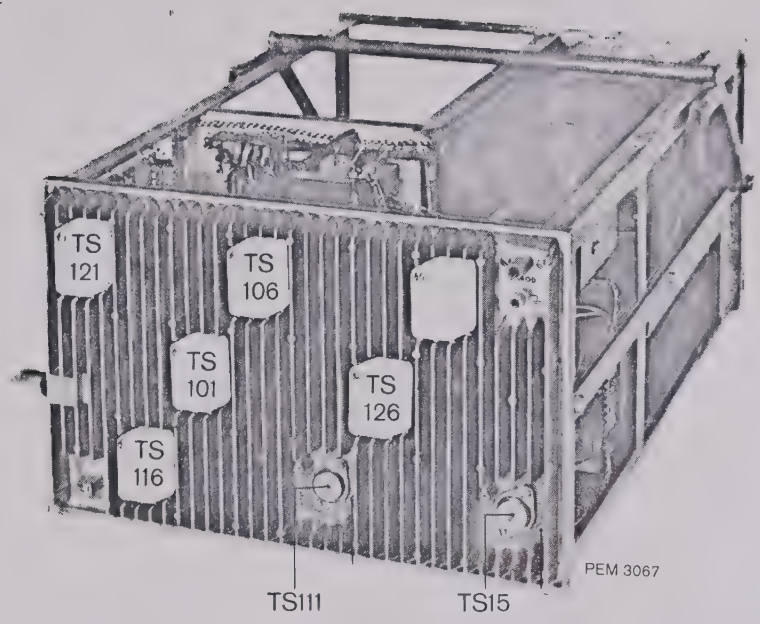



*Fig. 20. Gaining access to the power transistors*

## *Survey of adjusting elements and required auxiliary equipment*

IX

| *Adjustment* | *Element* | *Measuring instrument* | *Recommended PHILIPS measuring instrument* | *Section of chapter X* |
|---|---|---|---|---|
| MAINS CURRENT | — | Ammeter | PM 2411 | B |
| SUPPLY VOLTAGES | see table Chapter X.C. | Test unit<br>Oscilloscope | <br>PM 3206 | C |
| HIGH VOLTAGE | R89 | Valve voltmeter | GM 6001 | D |
| CATHODE RAY TUBE CIRCUIT | | | | |
| Beam centring | R97 | — | — | E1 |
| Coordinate axis | R5, R25 | L.F. Generator | PM 5101 | E2 |
| Barrel and cushion distortion | R95 | L.F. Generator | PM 5101 (2×) | E3 |
| Z-modulation | — | Square-wave generator | GM 2324 | E4 |
| CALIBRATION VOLTAGE | R54 | Accurately calibrated oscilloscope | PM 3206 (calibrated) | F |
| HORIZONTAL AMPLIFIER | | | | |
| Sensitivity | R9 | Test unit | | G1 |
| Square-wave reproduction | C2 | Test unit | | G2 |
| VERTICAL AMPLIFIER | | | | |
| Sensitivity | R36 | Test unit | | H1 |
| Square-wave reproduction | C15 | Test unit | | H2 |

## *Checking and adjusting*

### A. GENERAL INFORMATION

Checking and adjusting of the supply voltages and the amplifiers of the PM 3410 can be facilitated with the aid of the available test unit. This plug-in test unit is used in combination with the time base generator PM 3417, when adjusting the amplifiers. The test unit comprises, amongst others, a meter and a connection for an oscilloscope for measuring the ripple of the supply voltages. The built-in square-wave generator delivers an exact symmetrical square-wave voltage having a frequency of 0.5 MHz, an amplitude of 2 × 1.95 V (corresponding to a picture height of 6 cm) and a rise time of $< 7$ ns.

The tolerances given below are factory tolerances which apply only when the apparatus is readjusted. They may deviate from the data given in chapter II.

### B. MAINS CURRENT

- Connect the apparatus to a mains voltage of 220 V, 50 Hz.
- The current taken from the mains should not exceed 350 mA.

### C. SUPPLY VOLTAGES

- Insert the test unit into the upper opening of the basic instrument. (The lower compartment should be empty).
- Check the supply voltages with the aid of the 6-position switch of the test unit.
  The meter deflection may not exceed ± 0.5%.
- If necessary, adjust the supply voltages according to the following table.

A coarse adjustment is obtained by means of the choice resistors stated between brackets.

| *Voltage* | *Choice resistors* |
|---|---|
| +100 V | R163 (R162) unit D |
| + 50 V | R124 (R123) unit E |
| — 50 V | R111 (R109) unit G |
| + 15 V | R152 (R151) unit B |
| — 15 V | R138 (R137) unit C |
| + 6.3 V | R178 (R177) unit H |

- Next, in each position of the test selector, check that the meter variation is less than ± 0.5% in case of a load variation.
  The load variation is effected by means of switch "HIGH LOAD" on the test unit.
- Next, connect an oscilloscope to the test unit and measure the ripple of the supply voltages. This may not exceed 5 $mV_{p\text{-}p}$.

### D. E.H.T.

- Check that the voltage at point 2 (cathode) of the C.R.T. is —950 V, ± 2%.
- If necessary, select a different value for R89 (unit M). Coarse adjustment is effected by means of R88 (unit M).

### E. CATHODE RAY TUBE CIRCUIT

#### 1. Beam centring

- Display a time base line.
- Set R2 ("FOCUS") fully counter-clockwise.
- Check that the intensity of the de-focussed line is constant along its entire length.
  Adjusting element R97 ("BEAM CENTR").

#### 2. Position of the coordinate axis

##### a. With the aid of PM 3417 and PM 3418

- Display a time base line (position "AUT.").
- Check that the time base line runs horizontally.
  Adjustment element R5 ("TRACE ROT.").
- Set the selector switch for horizontal deflection to position "X-INPUT".
- Apply a sinusoidal voltage to the Y-input.
- Check the vertical position of the trace.
  Adjustment element R25 (Fig. 21).
- Repeat the check.

##### b. With the aid of PM 3419A and PM 3419B

- Insert the PM 3419A into the lower opening and the PM 3419B in the upper opening of the basic oscilloscope.
- Display a time base line (position "FREE RUN.").
- Check that the time base line runs horizontally.
  Adjusting element R5 ("TRACE ROT.").
- Interchange the plug-in units.
  For this, one of the guide blocks on the rear of each unit must be removed.
- Short-circuit pins 3 and 4 of plug A, Fig. 39.
- Check the vertical position of the trace.
  Adjusting element R25 (Fig. 21).
- Repeat the check.

#### 3. Barrel and cushion distortion

- Insert the PM 3417 in the upper and the PM 3418 in the lower opening of the basic oscilloscope.
- Apply a sinusoidal signal having a frequency of 50 Hz to the X-input (position "X-INPUT").
- Apply a sinusoidal signal having a frequency of approximately 100 kHz to the Y-input.
- Adjust to a trace height of 6 cm and a width of

8 cm, symmetrical with respect to the centre of the screen.
– Adjust the barrel and cushion distortion to minimum with R95 ("GEOM.", unit L).

#### 4. Z-modulation

– Check the Z-modulation with the aid of a square-wave voltage of 20 $V_{p-p}$, 1 kHz on BU4 and BU3 ("Z-MOD.").

### F. CALIBRATION VOLTAGE

– Check that the amplitude of the square-wave voltage on BU1 ("AMPL. CAL.") is 6 V ± 0.8%.
– The overshoot should be less than 0.8%.
Adjusting element R54 (fine) and R53 (coarse), unit A.

### G. HORIZONTAL AMPLIFIER

#### 1. Sensitivity

– Insert the test unit into the upper and the time base generator PM 3417 into the lower opening of the basic oscilloscope.
For this, one of the guide blocks on the rear of the time base unit must be removed.
– Check that the horizontal deflection is 6 cm.
Adjusting element R9 (unit K).

#### 2. Square-wave reproduction

– Adjust a triggered display and check that the square-wave reproduction is as shown in oscillogram 1.
Adjusting element C2 (unit K).

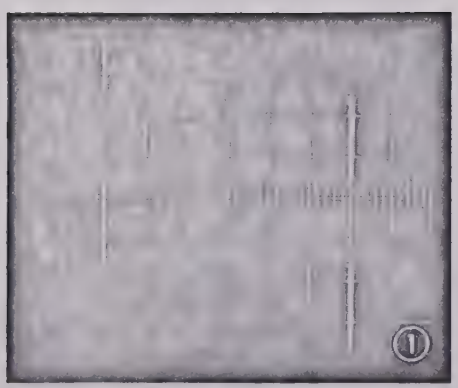
### H. VERTICAL AMPLIFIER

#### 1. Sensitivity

– Insert the test unit into the lower and the time base generator PM 3417 into the upper opening of the basic oscilloscope.
– Check that the vertical deflection is 6 cm.
Adjusting element R36, (unit L).

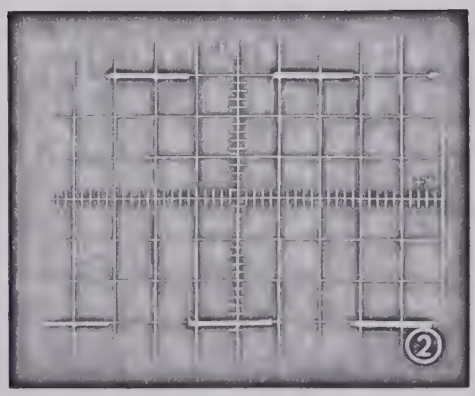
#### 2. Square-wave reproduction

– Adjust a triggered picture and check that the square-wave reproduction is as shown in oscillogram 2.
– Adjusting element C15 (unit L).
– Next, check that the rise time of the displayed voltage is ≦ 18 ns.




PEM 3902

*Oscillogram 1*




PEM 3902

*Oscillogram 2*

## *Replacing parts*

See chapter VIII for gaining access to parts.
After replacing parts, it may be necessary to readjust the relevant circuit. The apparatus should be switched off while replacing parts.

### A. CATHODE RAY TUBE

After replacing the cathode ray tube, carry out the following checks:

**1. Beam centring, coordinate axis, distortion**

– Carry out the checks according to chapter X, section E1, 2 and 3.

**2. Intensity**

– Display a sinusoidal voltage on the screen.
– Set R1 ("INTENS") fully clockwise.
– Check that the voltage across R94, mounted on the base of the C.R.T. does not exceed 3 V.
– If necessary, select a different value for R69 (unit O).
– Turn R1 anti-clockwise and check that the screen becomes dark at scale division 2 or 3 of R1. If necessary, select a different value for R65 (unit A) and repeat the check.

**Note:** The voltage across R94 must not exceed 3 V. If necessary also select a different value for R45.

### B. FUSES

The instrument is protected by means of fuses VL1 and VL2. VL1 is a thermal fuse mounted on supply transformer T3. Fuse VL2 is located on the right-hand side of the instrument and is accessible after removal of the top plate.

### C. PRINTED WIRING BOARDS

**1. Unit C (—15 V)**

Print plates unit C cannot be ordered from the Central Service Department. As a substitute for unit C, the print plate unit B should be used. Resistor R153 (22 kΩ) on this print plate should be replaced by a 15 kΩ resistor, corresponding tot R139 of unit C and resistor R145 (82 Ω) by a 100 Ω resistor corresponding to R130 of unit C.
After replacing one of the following panels, the relevant check should be carried out.

**2. Unit A**

– Connect an oscilloscope to BU1 ("AMPL. CAL.").
– Check that the amplitude of the calibration voltage is 6 V ± 0.8%. If necessary, select a different value for R54 (fine) or R53 (coarse) unit A.
– Check that the frequency of the calibration voltage is 1,000 Hz ± 100 Hz. Adjusting element C18 (unit A).
– Check the symmetry of the square-wave voltage. If necessary, adjust with the aid of R56 (unit A) and check the frequency again.

**3. Unit K (horizontal amplifier)**

– Set R9 to maximum resistance.
– Measure the emitter voltages of TS7 and TS8 with respect to earth.
– Check that the following conditions are met:
$|Ve7 - Ve8| \leqq 5$ V.
$\frac{Ve7 + Ve8}{2} = 50$ V ± 1%.
– If necessary, adjust with R17 and subsequently readjust R9 according to chapter X.G.1.

**4. Unit L (vertical amplifier)**

– Set R36 to maximum resistance.
– Measure the collector voltages of TS9 and TS12 with respect to earth.
– Check that the following conditions are met:
$|Vc12 - Vc9| \leqq 5$ V.
$\frac{Vc12 + Vc9}{2} = 50$ V ± 1%.
– If necessary, adjust with R48 and subsequently readjust R36 as described in Chapter X.H.1.

### D. SEMI-CONDUCTORS

**1. TS1 . . . TS8**

After replacing one of these transistors, carry out the check described under point C3 for unit K.

**2. TS9 . . . TS12**

After replacing one of these transistors, carry out the check described under point C4 for unit L.

**3. TS121**

For transistor TS121 (AU104), always select a transistor having a base leakage current Icbo which is less than 0.3 mA at a collector-emitter voltage Vce of 100 V and at a temperature of 25 °C.

**4. GR1, GR2 and GR3**

For Zener diodes GR1 . . . 3, always select such diodes that the sum zener voltage of the three series connected diodes is 18.3 V ± 0.2 V.

**5. Power transistors**

To ensure proper heat transmission, both sides of the mica insulation plate between transistor housing and rear panel should be greased with silicone grease.

## Fault finding

To facilitate fault finding, the d.c. voltages present at various places in the circuit diagrams have been indicated.
These voltages, which merely serve as a guide, have been measured with d.c. valve voltmeter PM 2430. All leads indicated by a zero in the circuit diagrams have been commonly earthed on the mounting plate on which connection plugs A and B are also mounted. The leads provided with an earthing symbol have been connected to earth via the shortest route.

**Remark:** In case of breakdowns, one can always apply to the world-wide PHILIPS Service Organisation.
Whenever the instrument is to be sent to a PHILIPS Service Centre for repairs, the following points should be observed:

- tie on a label bearing full name and address of the sender.
- indicate as completely as possible the symtom(s) of the fault(s).
- carefully pack the instrument in the original packing, or if no longer available in a wooden crate.
- send the instrument, *together with two plug-in units,* to the address provided by your local PHILIPS representative.

## A. MECHANICAL PARTS

| *Item* | *Fig.* | *Qty.* | *Ordering number* | *Description* | *„S"* |
|---|---|---|---|---|---|
| 1 | 22 | 1 | 4822 459 40067 | Mask | * |
| 2 | 22 | 1 | 4822 450 10018 | Graticule | * |
| 3 | 22 | 1 | 4822 480 30035 | Contrast material | ** |
| 4 | 22 | 4 | 4822 502 10418 | Bolt | ** |
| 5 | 22 | 4 | 4822 413 30082 | Knob | * |
| 6 | 22 | 4 | 4822 413 70038 | Cap | |
| 7 | 22 | 1 | 4822 277 10021 | Mains switch | * |
| 8 | 22 | 2 | 4822 290 40011 | Connection terminal (BU1, 4) | * |
| 9 | 22 | 2 | 4822 290 40012 | Connection terminal (BU2, 3) | ** |
| 10 | 22 | 1 | 4822 455 80002 | Instruction plate | * |
| 11 | 22 | 2 | 4822 255 20022 | Lamp holder | * |
| 12 | 22 | 2 | 4822 267 70005 | Plug socket | * |
| 13 | 22 | 4 | 4822 462 70075 | Rubber foot | ** |
| 14 | 23 | 2 | 4822 462 40052 | Rubber foot (tilting bracket) | ** |
| 15 | 23 | 1 | 4822 320 20014 | E.H.T. cable | * |
| 16 | 23 | 1 | 4822 290 30044 | E.H.T. plug | * |
| 17 | 23 | 14 | 4822 462 30088 | Guide strip | * |
| 18 | 24 | 3 | 4822 462 40006 | Rubber support | * |
| 19 | 24 | 1 | 4822 272 10003 | Voltage adapter | ** |
| 20 | 24 | 1 | 4822 256 40012 | Fuse-holder (VL2) | * |
| 21 | 25 | 1 | 4822 255 10007 | Pilot lamp holder (LA1) | * |
| 22 | 25 | 4 | 4822 532 20158 | Coupling socket (for R1 . . . 4) | ** |
| 23 | 25 | 20 | 4822 535 90178 | Ceramic tube | ** |
| 24 | — | 7 | 4822 693 90088 | Mica insulation plate for power transistors | * |
| 25 | — | 16 | 4822 325 60072 | Insulation grommet for power transistors and current bracket | |
| 26 | 24 | 1 | 555 66 | Base for C.R.T. | * |
| 27 | 24 | 5 | 555 61 | Connection plug for deflection plates C.R.T. | * |
| — | — | 7 | 4822 255 40011 | Transistor holder for power transistors | * |

**Purpose of column "S"**

**– Components not marked**

These components should be present at the Service Department in the relevant country, or in the stock of the customer who is using the instrument.

These include:

a. All electrical components.

b. Mechanical parts which are vulnerable, or which are subject to wear.

**– Components marked with one asterisk**

These components generally have a long or unlimited service life, but their presence is essential for the correct working of the instrument. Stocking up of a few of these components depends on the following factors:

a. The number of instruments present in the country concerned.

b. The necessity of having the instrument working continuously or not.

c. The time of delivery of the components with respect to the import restrictions in the country concerned and the duration of transport.

**– Components marked with two asterisks**

These components have a long or unlimited service life and they are not essential for the correct working of the instrument. Generally they are not stocked locally.

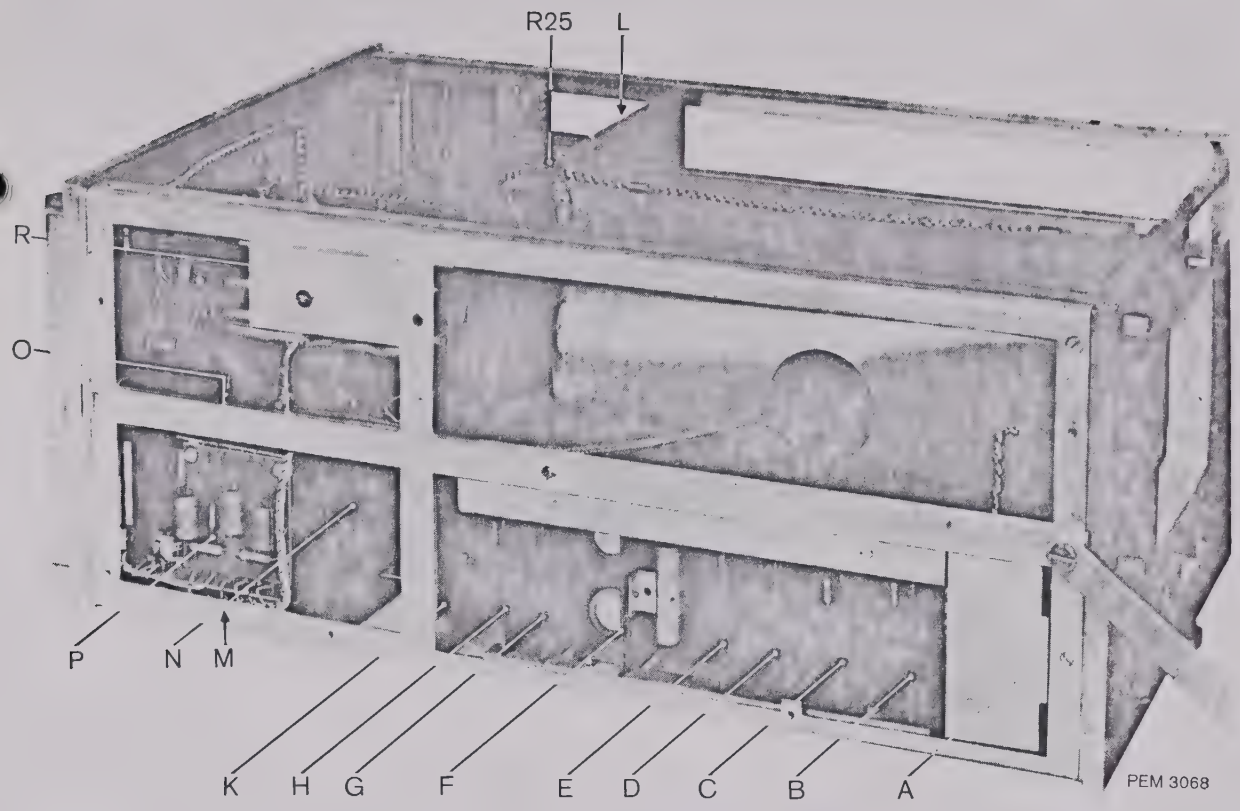



*Fig. 21. Location of the print plates*

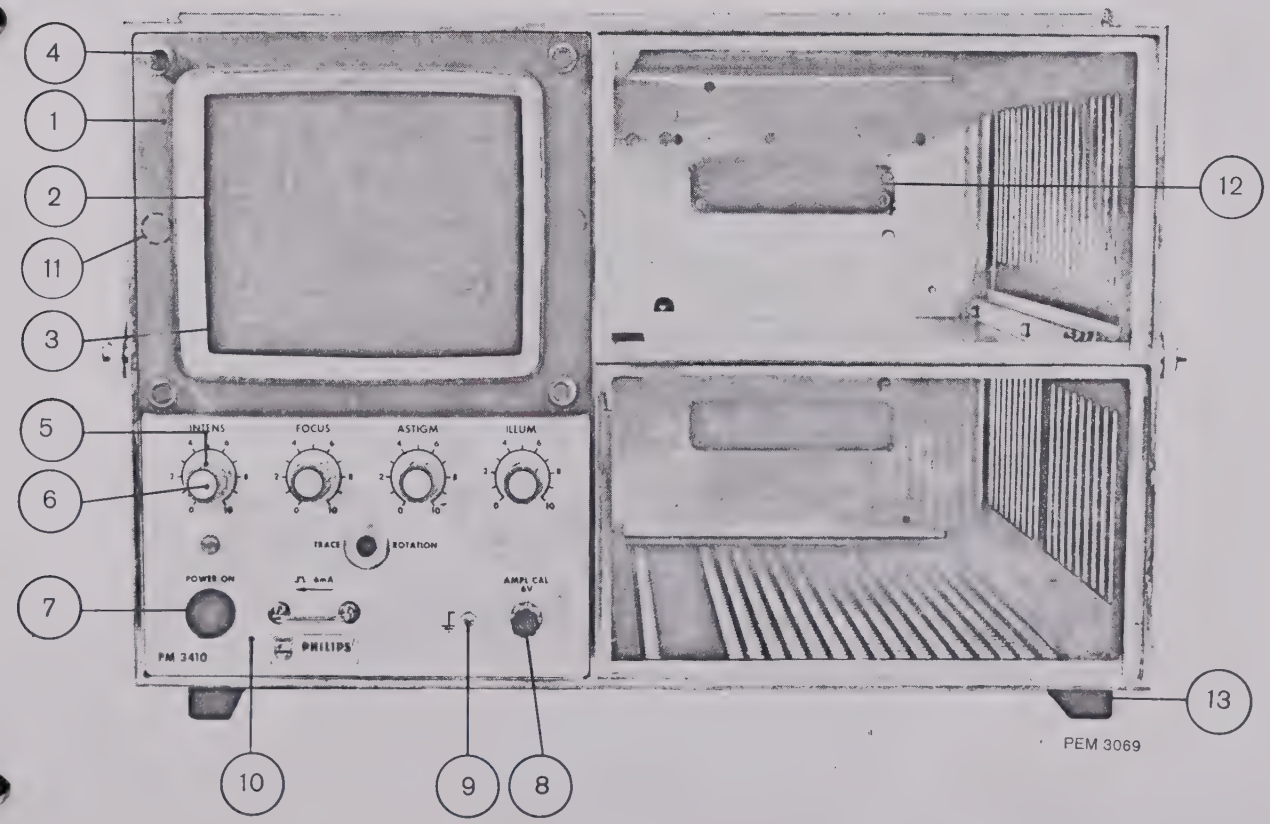



*Fig. 22. Front view with item numbers*

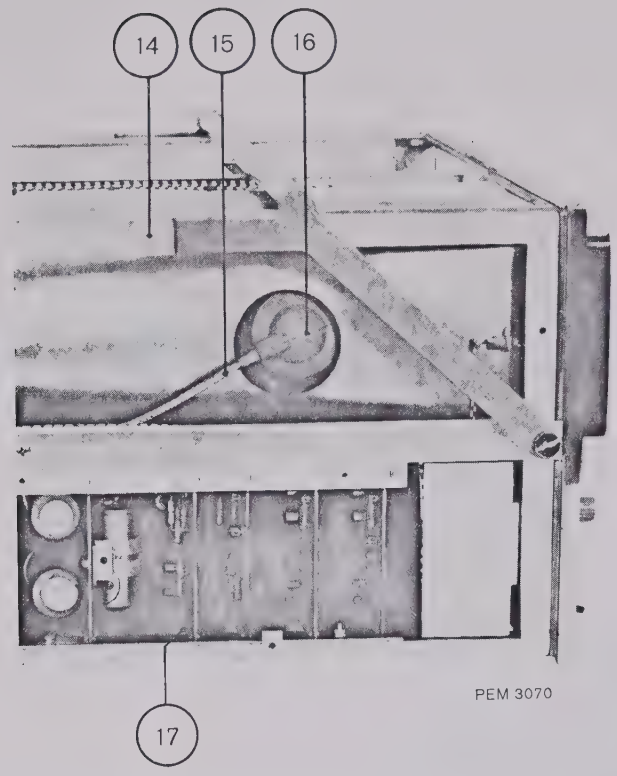



*Fig. 23. Left side view with item numbers*

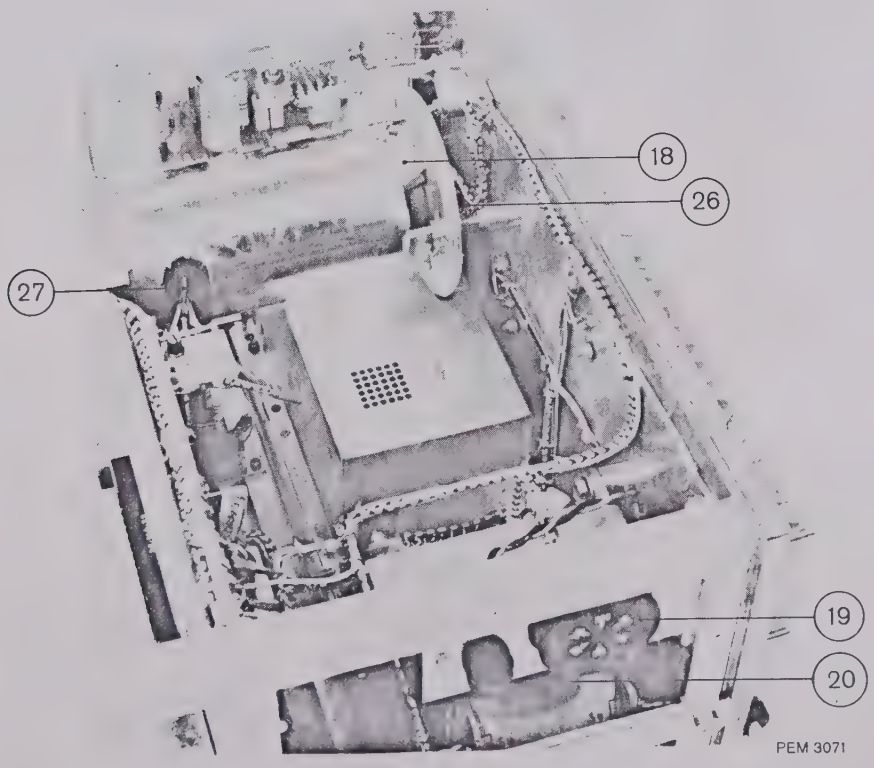



*Fig. 24. Top view with item numbers*

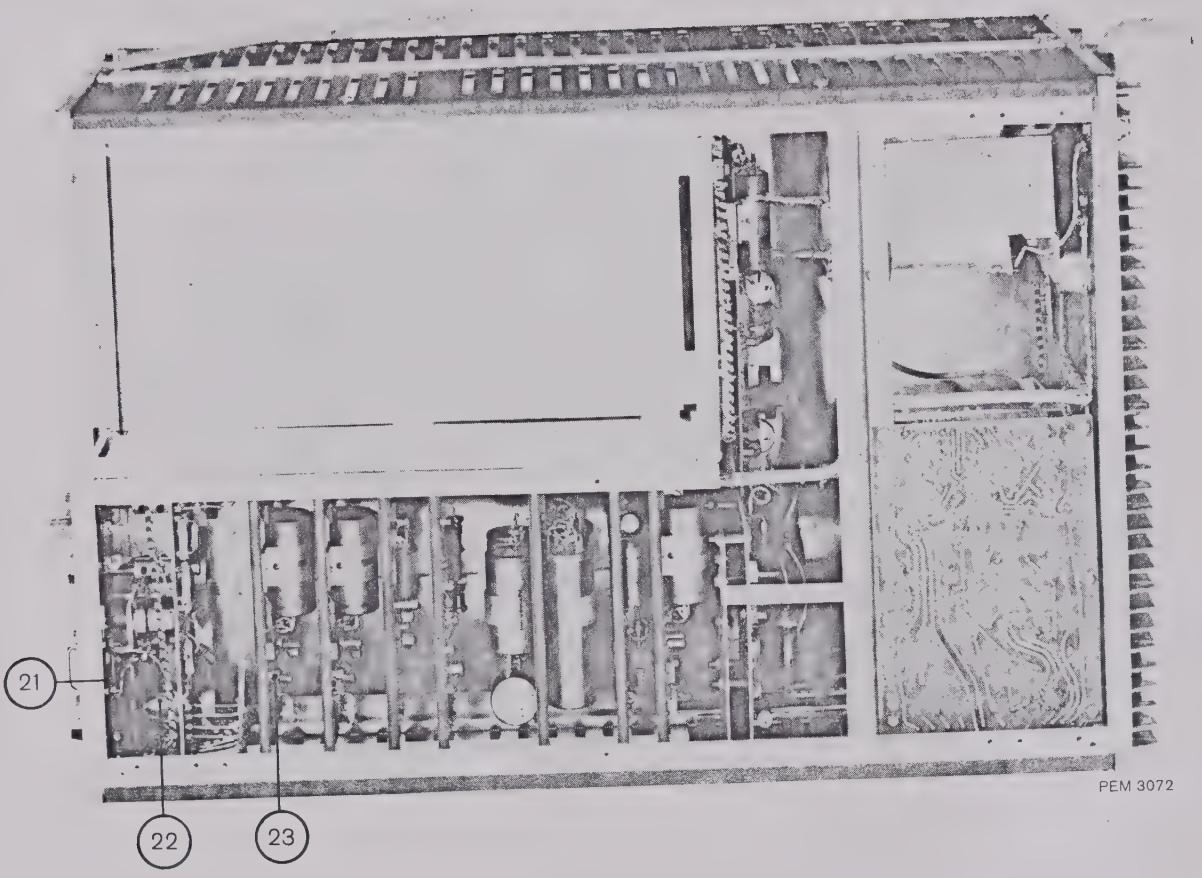



*Fig. 25. Bottom view with item numbers*

**RESISTORS**

| *Item* | *Ordering number* | *Value* | | *%* | *W* | *Description* |
|---|---|---|---|---|---|---|
| R1 | 4822 101 20116 | 1 | MΩ | | | Carbon potentiometer |
| R2 | 4822 101 20118 | 2 | MΩ | | | Carbon potentiometer |
| R3 | 4822 101 20113 | 100 | kΩ | | | Carbon potentiometer |
| R4 | 4822 103 30001 | 30 | Ω | | | Wire wound potentiometer |
| R5 | 4822 103 20094 | 10 | kΩ | | 3 | Wire wound potentiometer |
| R9 | 4822 101 20076 | 4.7 | kΩ | | | Carbon potentiometer |
| R23 | 4822 116 60013 | 4.7 | kΩ | | 4 | Metal oxide resistor |
| R25 | 4822 103 20092 | 2.2 | kΩ | | 3 | Wire wound potentiometer |
| R28, R29, R31 | 4822 116 60013 | 4.7 | kΩ | | 4 | Metal oxide resistor |
| R36 | 4822 101 70007 | 1 | kΩ | | | Carbon potentiometer |
| R41, R44 | 4822 116 60014 | 750 | Ω | | 6 | Metal oxide resistor |
| R52 | 4822 116 60015 | 250 | Ω | | 4 | Metal oxide resistor |
| R80 | 4822 113 60029 | 3.9 | Ω | | 2 | Wire wound resistor |
| R95 | 4822 101 20079 | 220 | kΩ | | | Carbon potentiometer |
| R97 | 4822 101 20075 | 47 | kΩ | | | Carbon potentiometer |
| R131 | 4822 113 60073 | 1.8 | Ω | 10 | 2 | Wire wound resistor |
| R144 | 4822 113 60073 | 1.8 | Ω | 10 | 2 | Wire wound resistor |
| R171 | 4822 113 60024 | 0.56 | Ω | | 2 | Wire wound resistor |

## CAPACITORS

| *Item* | *Ordering number* | *Value* | *V* | *Description* |
|---|---|---|---|---|
| C2 | 4822 125 60031 | 25 pF | | Trimmer |
| C3, C5, C6 | 4822 121 40047 | 10 nF | 30 | Plate capacitor |
| C8, C11 | 4822 121 40055 | 47 nF | 30 | Plate capacitor |
| C14 | 4822 121 40047 | 10 nF | 30 | Plate capacitor |
| C22 | 4822 124 20086 | 12.5 µF | 25 | Electrolytic capacitor |
| C24 | 4822 124 20094 | 100 µF | 64 | Electrolytic capacitor |
| C26 | 4822 124 40007 | 500 µF | 64 | Electrolytic capacitor |
| C27 | 4822 124 20094 | 100 µF | 64 | Electrolytic capacitor |
| C28, C29 | 4822 121 30064 | 15 nF | 1600 | Paper capacitor |
| C30 | 4822 121 30068 | 1.8 nF | 1600 | Paper capacitor |
| C31 | 4822 121 30064 | 15 nF | 1600 | Paper capacitor |
| C32 | 4822 121 30069 | 1.8 nF | 5000 | Paper capacitor |
| C33, C36 | 4822 121 30064 | 15 nF | 1600 | Paper capacitor |
| C37 | 4822 121 40012 | 100 nF | 160 | Polyester capacitor |
| C40 | 4822 121 30064 | 15 nF | 1600 | Paper capacitor |
| C41, C42, C43 | 4822 121 40012 | 100 nF | 160 | Polyester capacitor |
| C44 | 4822 124 20045 | 80 µF | 100 | Electrolytic capacitor |
| C46 | 4822 121 40047 | 10 nF | 30 | Plate capacitor |
| C47 | 4822 121 40012 | 100 nF | 160 | Polyester capacitor |
| C101 | 4822 124 20094 | 100 µF | 64 | Electrolytic capacitor |
| C102 | 4822 124 20016 | 80 µF | 25 | Electrolytic capacitor |
| C103 | 4822 124 40017 | 500 µF | 100 | Electrolytic capacitor |
| C106 | 4822 124 20093 | 10 µF | 64 | Electrolytic capacitor |
| C107 | 4822 124 20094 | 100 µF | 64 | Electrolytic capacitor |
| C108 | 4822 124 40017 | 500 µF | 100 | Electrolytic capacitor |
| C109 | 4822 124 20093 | 10 µF | 64 | Electrolytic capacitor |
| C111 | 4822 124 20094 | 100 µF | 64 | Electrolytic capacitor |
| C112 | 4822 124 70009 | 1250 µF | 25 | Electrolytic capacitor |
| C113 | 4822 124 20077 | 10 µF | 16 | Electrolytic capacitor |
| C114 | 4822 124 20026 | 400 µF | 16 | Electrolytic capacitor |
| C116 | 4822 124 70009 | 1250 µF | 25 | Electrolytic capacitor |
| C117 | 4822 124 20077 | 10 µF | 16 | Electrolytic capacitor |
| C118 | 4822 124 20026 | 400 µF | 16 | Electrolytic capacitor |
| C119, C121 | 4822 124 70016 | 100 µF | 200 | Electrolytic capacitor |
| C123 | 4822 124 20086 | 12.5 µF | 25 | Electrolytic capacitor |
| C126 | 4822 124 20181 | 64 µF | 150 | Electrolytic capacitor |
| C127, C128 | 4822 124 70008 | 2000 µF | 16 | Electrolytic capacitor |
| C129 | 4822 124 20047 | 25 µF | 6.4 | Electrolytic capacitor |
| C132 | 4822 124 20078 | 125 µF | 10 | Electrolytic capacitor |

## PRINTED WIRING BOARDS WITH PARTS

| *Unit* | *Ordering number* | *Description* |
|---|---|---|
| A* | 4822 216 50069 | Calibration generator and front plate potentiometers |
| B | 4822 216 50071 | + 15 V supply print |
| C | See chapter XI-C1 | — 15 V supply print |
| D | 4822 216 50072 | +100 V supply print |
| E | 4822 216 50073 | + 50 V supply print |
| G | 4822 216 50099 | — 50 V supply print |
| H | 4822 216 50074 | + 6.3 V supply print |
| K* | 4822 216 50075 | Horizontal output amplifier |
| L* | 4822 216 50076 | Vertical output amplifier |
| M | 4822 216 50077 | High voltage prints |
| N | 4822 216 50078 | High voltage prints |
| P | 4822 216 50081 | High voltage prints |
| R | 4822 216 50082 | 40 V supply print for beam centring |
| J | 4822 216 50083 | Wiring print |

* See also chapter XI-C

## SEMI-CONDUCTORS AND VALVES

| *Item* | *Type* | *Description* |
|---|---|---|
| TS1* | BFX37 | Transistor (Fairchild) |
| TS2* | BFX37 | Transistor (Fairchild) |
| TS3* | BF109 | Transistor |
| TS4* | BSY39 | Transistor |
| TS5* | BSY39 | Transistor |
| TS6* | BF109 | Transistor |
| TS7* | BF109 | Transistor |
| TS8* | BF109 | Transistor |
| TS9* | BFY44 | Transistor |
| TS10* | BSY39 | Transistor |
| TS11* | BSY39 | Transistor |
| TS12* | BFY44 | Transistor |
| TS13 | BF109 | Transistor |
| TS14 | BF109 | Transistor |
| TS15* | AU104 | Transistor |
| TS16 | ASY27 | Transistor |
| TS17 | BF109 | Transistor |
| TS101* | AU103 | Transistor |
| TS102 | BCY40 | Transistor |
| TS103 | AC126 | Transistor |
| TS104 | BCY32S | Transistor |
| TS105 | BCY32S | Transistor |
| TS106* | AU103 | Transistor |
| TS107 | BCY40 | Transistor |
| TS108 | AC126 | Transistor |
| TS109 | BCY32S | Transistor |
| TS110 | BCY32S | Transistor |
| TS111* | ASZ15 | Transistor |
| TS112 | BCY40 | Transistor |
| TS113 | AC126 | Transistor |
| TS114 | BCY32S | Transistor |
| TS115 | BCY32S | Transistor |
| TS116* | ASZ15 | Transistor |
| TS117 | BCY40 | Transistor |
| TS118 | AC126 | Transistor |
| TS119 | BCY32S | Transistor |
| TS120 | BCY32S | Transistor |
| TS121* | AU104 | Transistor |
| TS122 | BCY32S | Transistor |
| TS123 | AC126 | Transistor |
| TS124 | BCY32S | Transistor |
| TS125 | BCY32S | Transistor |
| TS126* | ASZ15 | Transistor |
| TS127 | BCY40 | Transistor |
| TS128 | AC126 | Transistor |
| TS129 | AC126 | Transistor |
| TS130 | BCY32S | Transistor |
| TS131 | BCY32S | Transistor |
| GR1* | BZY58 | Zener diode |
| GR2* | BZY58 | Zener diode |
| GR3* | BZY58 | Zener diode |
| GR4 | AAZ18 | Germanium diode |
| GR5 | AAZ18 | Germanium diode |
| GR6 | BY100S | Silicon diode |
| GR7 | BY100S | Silicon diode |
| GR8 | BY100S | Silicon diode |
| GR9 | BY100S | Silicon diode |
| GR10 | BY140 | Silicon diode |
| GR11 | BY140 | Silicon diode |
| GR12 | BY140 | Silicon diode |
| GR24 | AAY11 | Germanium diode |
| GR26 | BZY56 | Zener diode |
| GR27 | BZY61 | Zener diode |
| GR28 | BZY61 | Zener diode |
| GR29 | BZY61 | Zener diode |
| GR30 | BZY61 | Zener diode |
| GR31 | BZY61 | Zener diode |
| GR32 | BZY61 | Zener diode |

* See also chapter XI-D

| Item | Type | Description |
|---|---|---|
| GR33 | BY100S | Silicon diode |
| GR101 | BY100S | Silicon diode |
| GR102 | BZZ27 | Zener diode |
| GR103 | BY100S | Silicon diode |
| GR104 | BY100S | Silicon diode |
| GR105 | BY100S | Silicon diode |
| GR106 | BY100S | Silicon diode |
| GR107 | BZY56 | Zener diode |
| GR108 | BZY58 | Zener diode |
| GR109 | BY100S | Silicon diode |
| GR110 | BY100S | Silicon diode |
| GR111 | BY100S | Silicon diode |
| GR112 | BY100S | Silicon diode |
| GR113 | BZY56 | Zener diode |
| GR114 | BZY58 | Zener diode |
| GR115 | BY100S | Silicon diode |
| GR116 | BY100S | Silicon diode |
| GR117 | BY100S | Silicon diode |
| GR118 | BY100S | Silicon diode |
| GR119 | BZY56 | Zener diode |
| GR120 | BZY58 | Zener diode |
| GR121 | BY100S | Silicon diode |
| GR122 | BY100S | Silicon diode |

| Item | Type | Description |
|---|---|---|
| GR123 | BY100S | Silicon diode |
| GR124 | BY100S | Silicon diode |
| GR125 | BZY56 | Zener diode |
| GR126 | BZY58 | Zener diode |
| GR127 | BY100S | Silicon diode |
| GR128 | BY100S | Silicon diode |
| GR129 | BY100S | Silicon diode |
| GR130 | BY100S | Silicon diode |
| GR131 | BZY60 | Zener diode |
| GR132 | BYX21/200 | Silicon diode |
| GR133 | BYX21/200R | Silicon diode |
| GR134 | BYX21/200 | Silicon diode |
| GR135 | BYX21/200R | Silicon diode |
| GR136 | BZY56 | Zener diode |
| GR137 | OA47 | Germanium diode |
| GR138 | OA47 | Germanium diode |
| GR139 | OA47 | Germanium diode |
| GR140 | OA47 | Germanium diode |
| GR141 | OA47 | Germanium diode |
| GR142 | OA47 | Germanium diode |
| B1 | 5718 | Miniature valve |
| B2 | D14-10GH | Cathode ray tube |
| B101 | ZZ1000 | Neon tube |

**MISCELLANEOUS**

| Item | Ordering number | Value | Description |
|---|---|---|---|
| T1 | 4822 158 30059 | | Transformer |
| T2 | 4822 142 60096 | | High voltage transformer |
| T3 | 4822 146 80065 | | Supply transformer |
| L1, L2 | 4822 156 20302 | 2.9—4 µH | Coil |
| L3 | 4822 157 50212 | | Rotation coil |
| VL1 | 4822 252 20004 | 125 °C | Thermal fuse |
| VL2 | 4822 253 30021 | 1A | Fuse |
| | 4822 253 30025 | 2A | |
| LA1 | 8034D | 10V/0.2A | Pilot lamp |
| LA2, LA3 | 6828 | 6V/0.1A | Graticule illumination lamp |
| — | 4822 466 10023 | | |
| | (4822 159 00561) | | Extension print plate for units |
| — | 4822 466 10024 | | B, C, E, F, G and H |
| | (4822 159 00562) | | Extension print plate for unit D |
| — | 4822 395 30015 | | Test unit for checking and adjusting the PM 3410 |

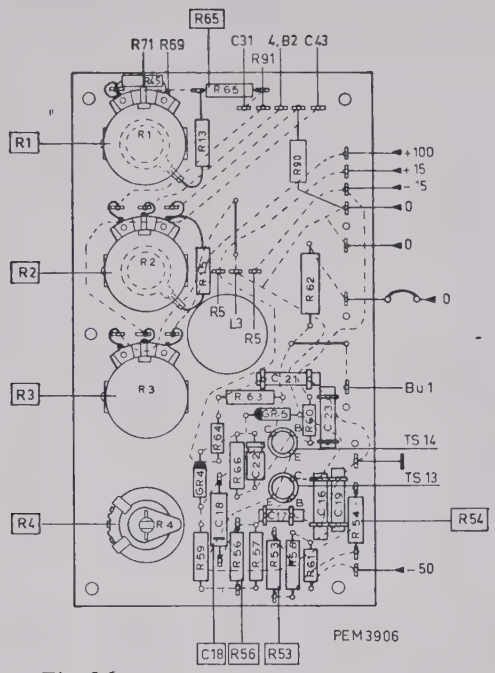



*Fig. 26.*
*Unit A print plate,*
*calibration generator*

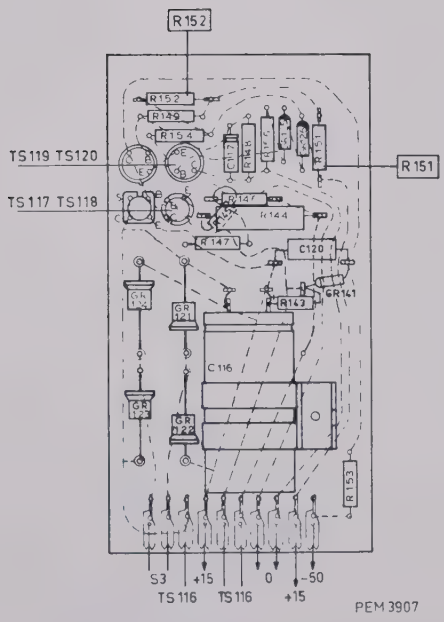



*Fig. 27.*
*Unit B print plate,*
*+15 V*

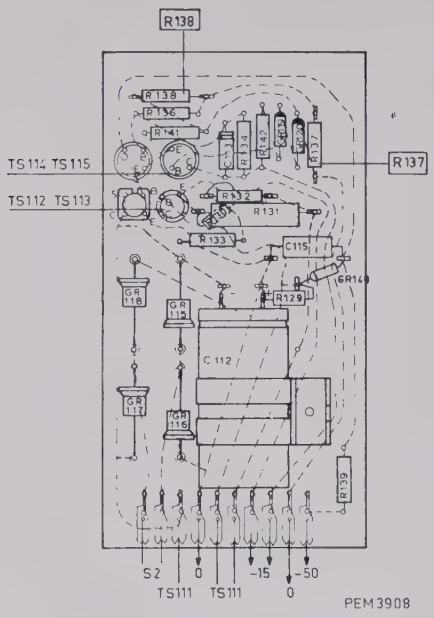



*Fig. 28. Unit C print plate, —15 V*

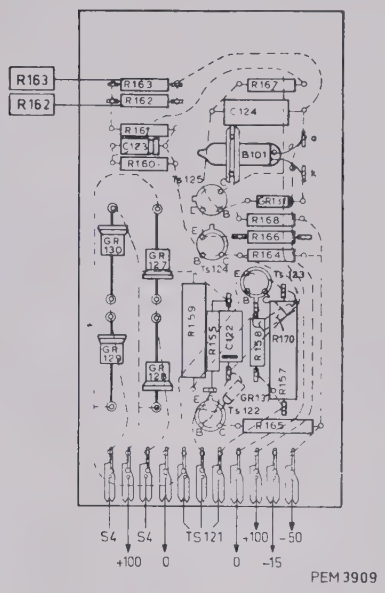



*Fig. 29. Unit D print plate, +100 V*

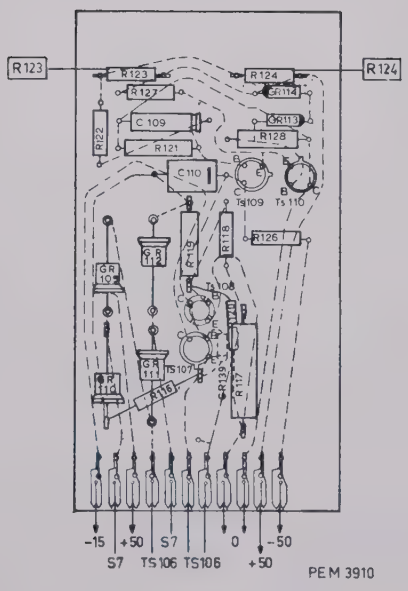



*Fig. 30. Unit E print plate, +50 V*

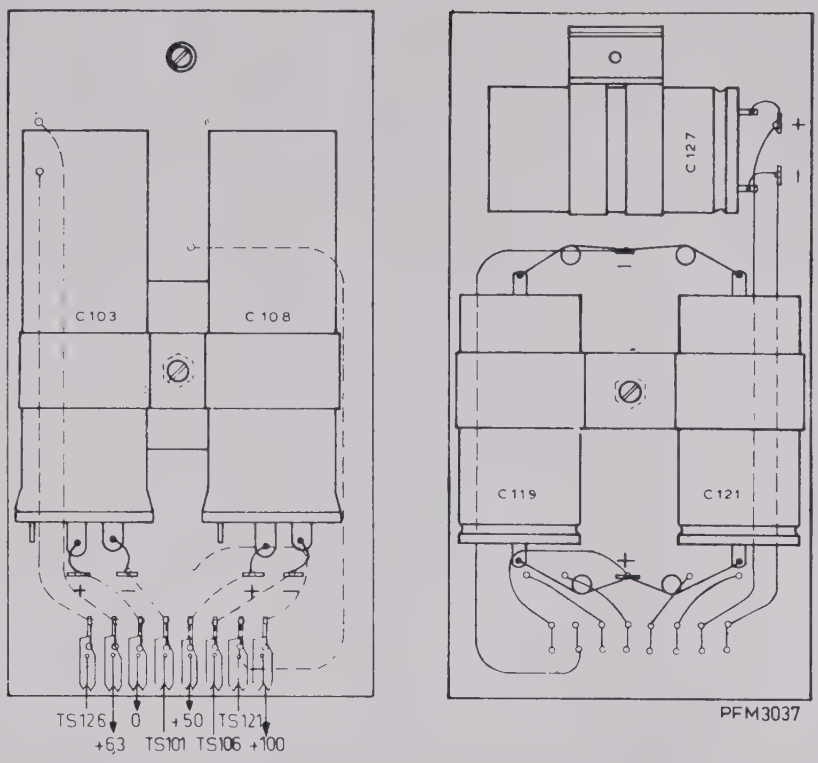



*Fig. 31. Unit F print plate*

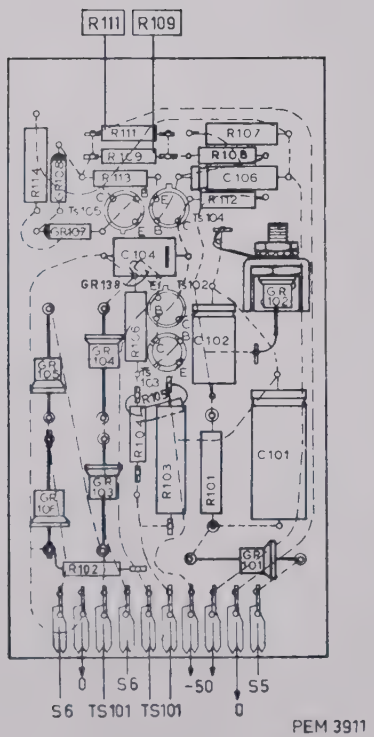



*Fig. 32. Unit G print plate, —50 V*

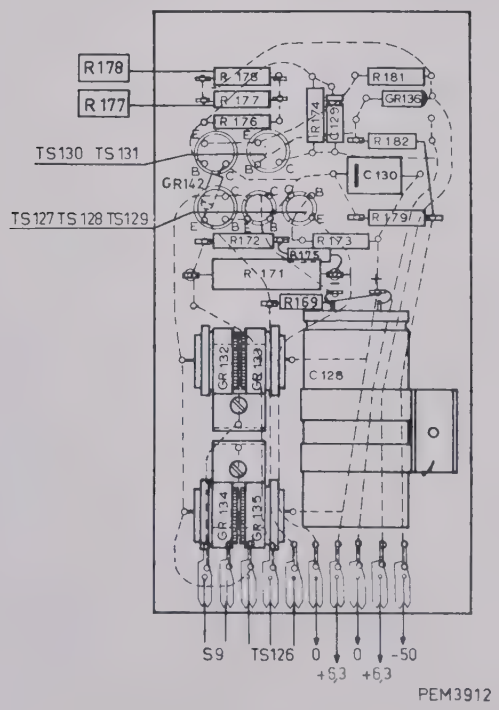



*Fig. 33. Unit H print plate, +6.3 V*

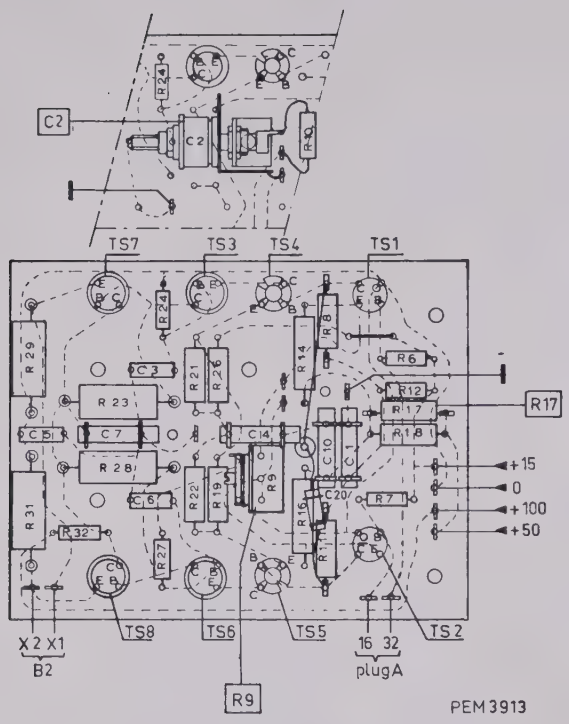



*Fig. 34.*
*Unit K print plate,*
*X-amplifier*

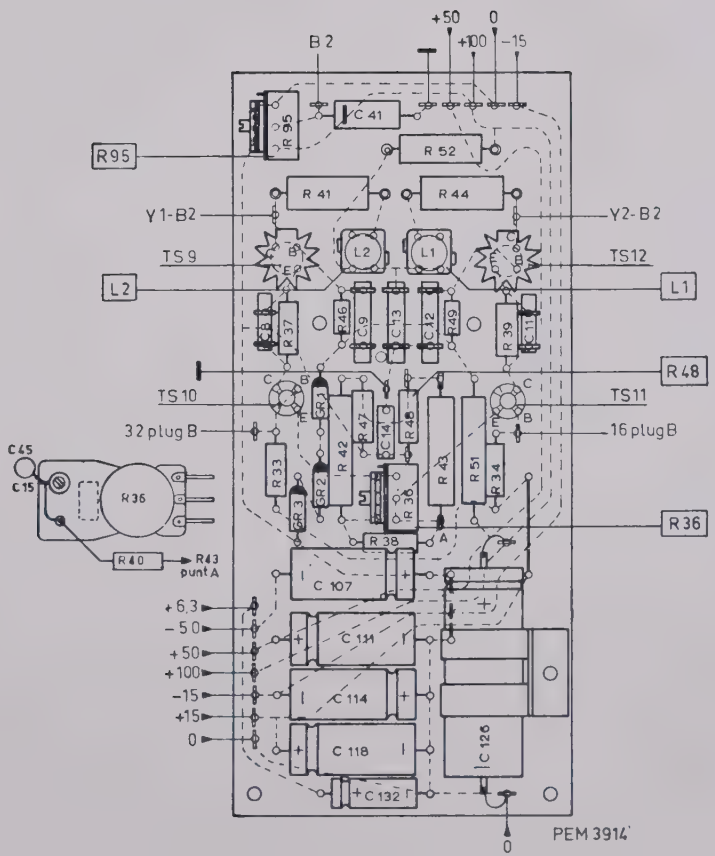
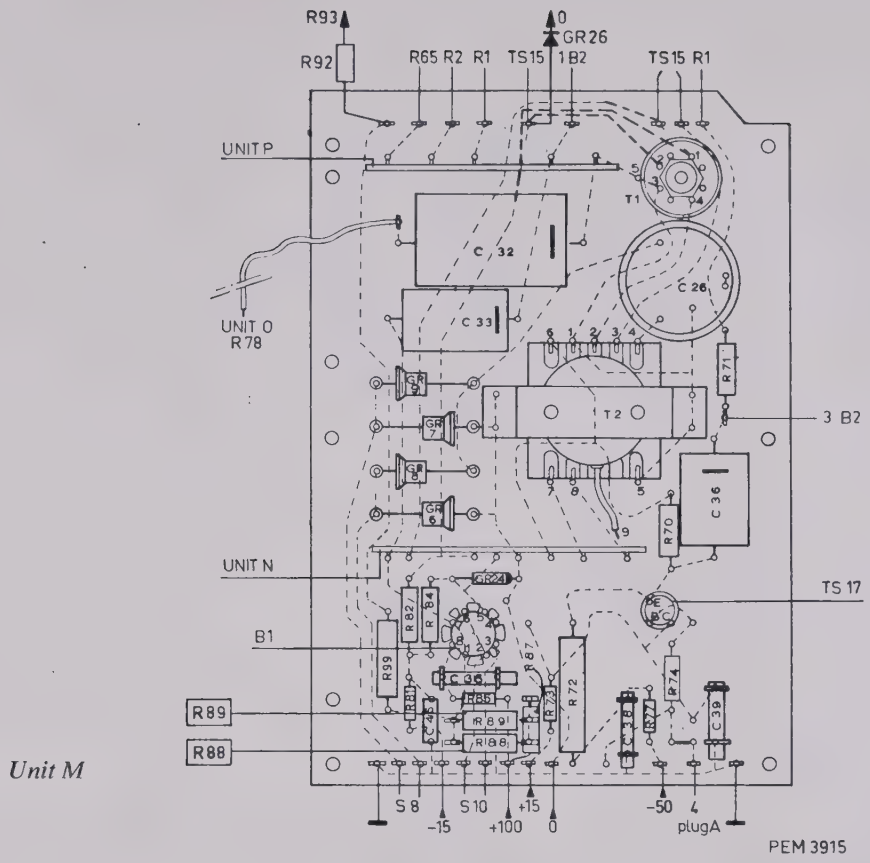
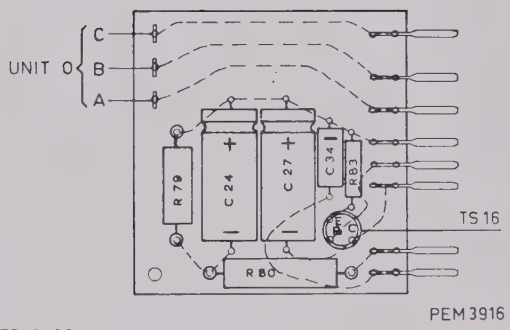


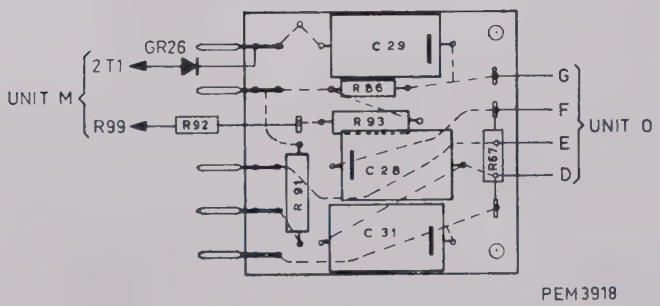

*Fig. 35.*
*Unit L print plate,*
*Y-amplifier*



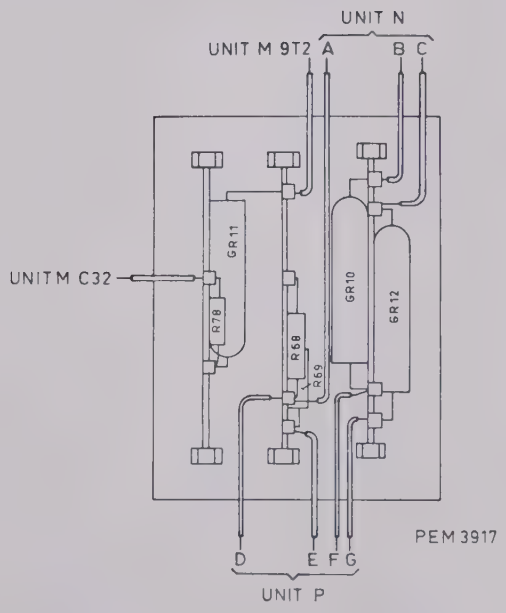

*Unit M*




*Unit N*




*Unit P*




*Unit O*

*Fig. 36.*
*Units M, N, O, P print plates, high voltage*

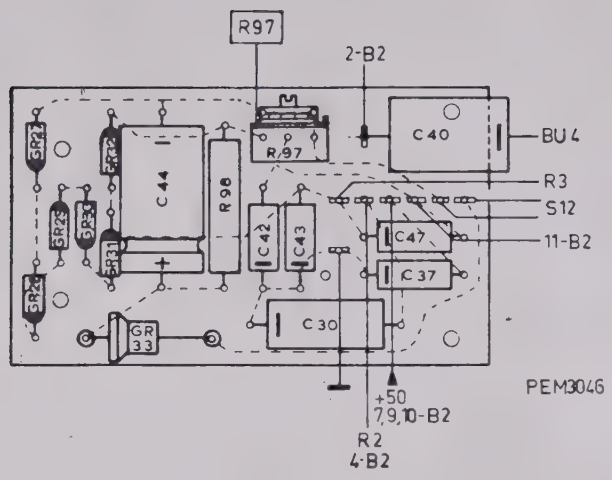



*Fig. 37.*
*Unit R print plate, beam centring*

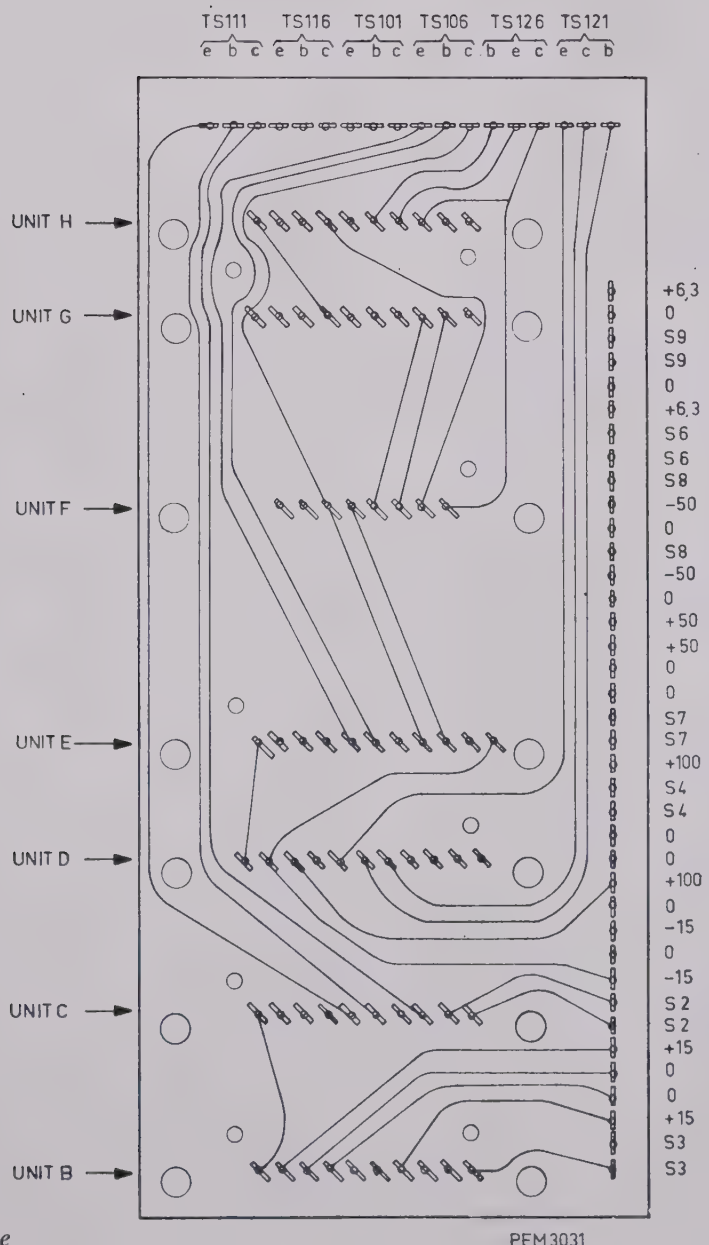
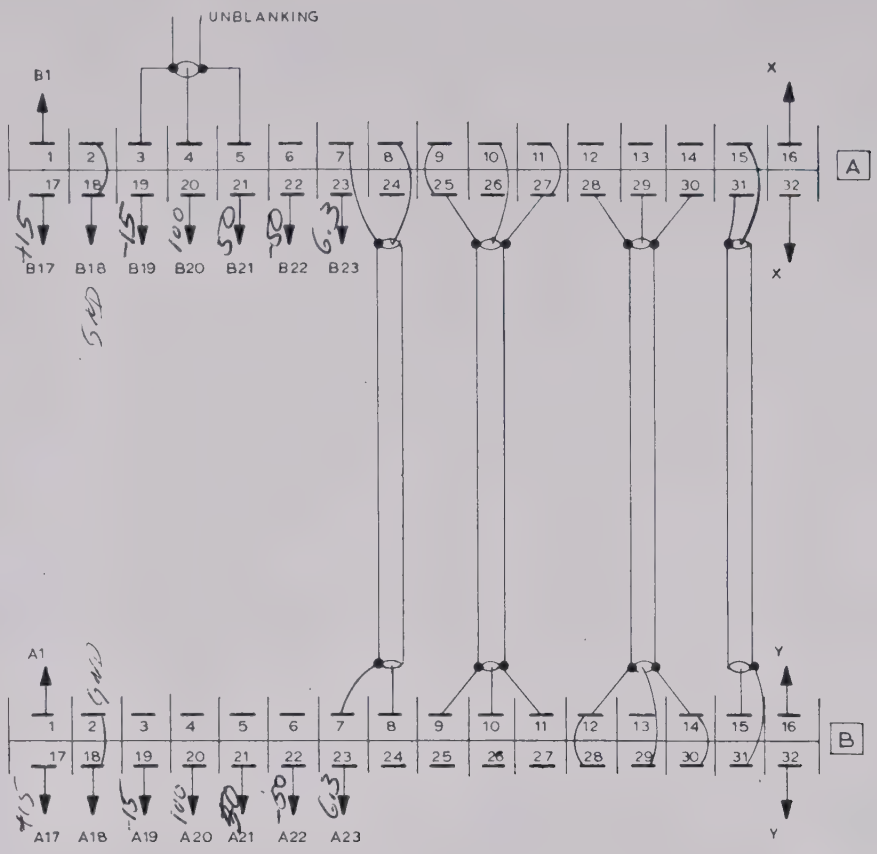
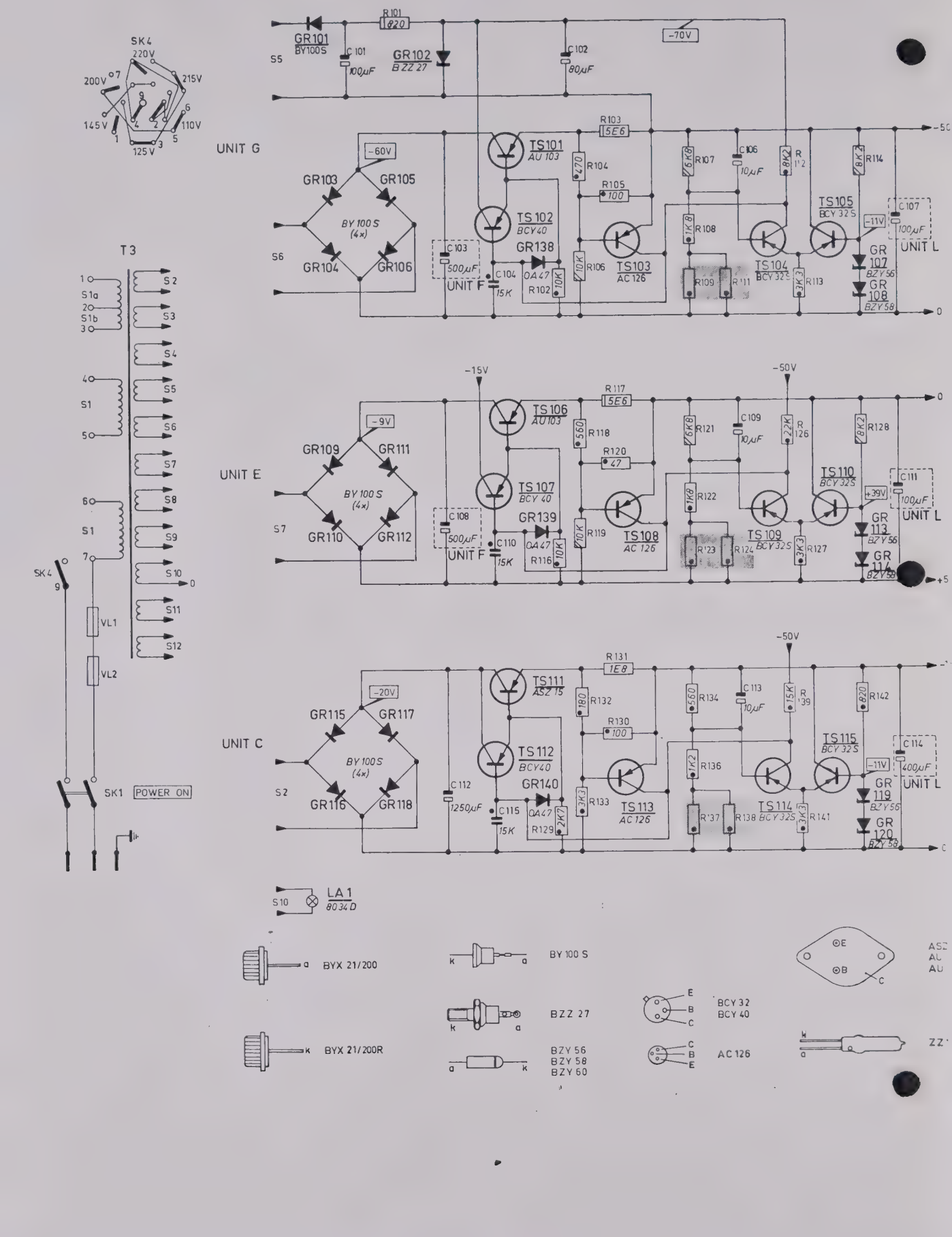


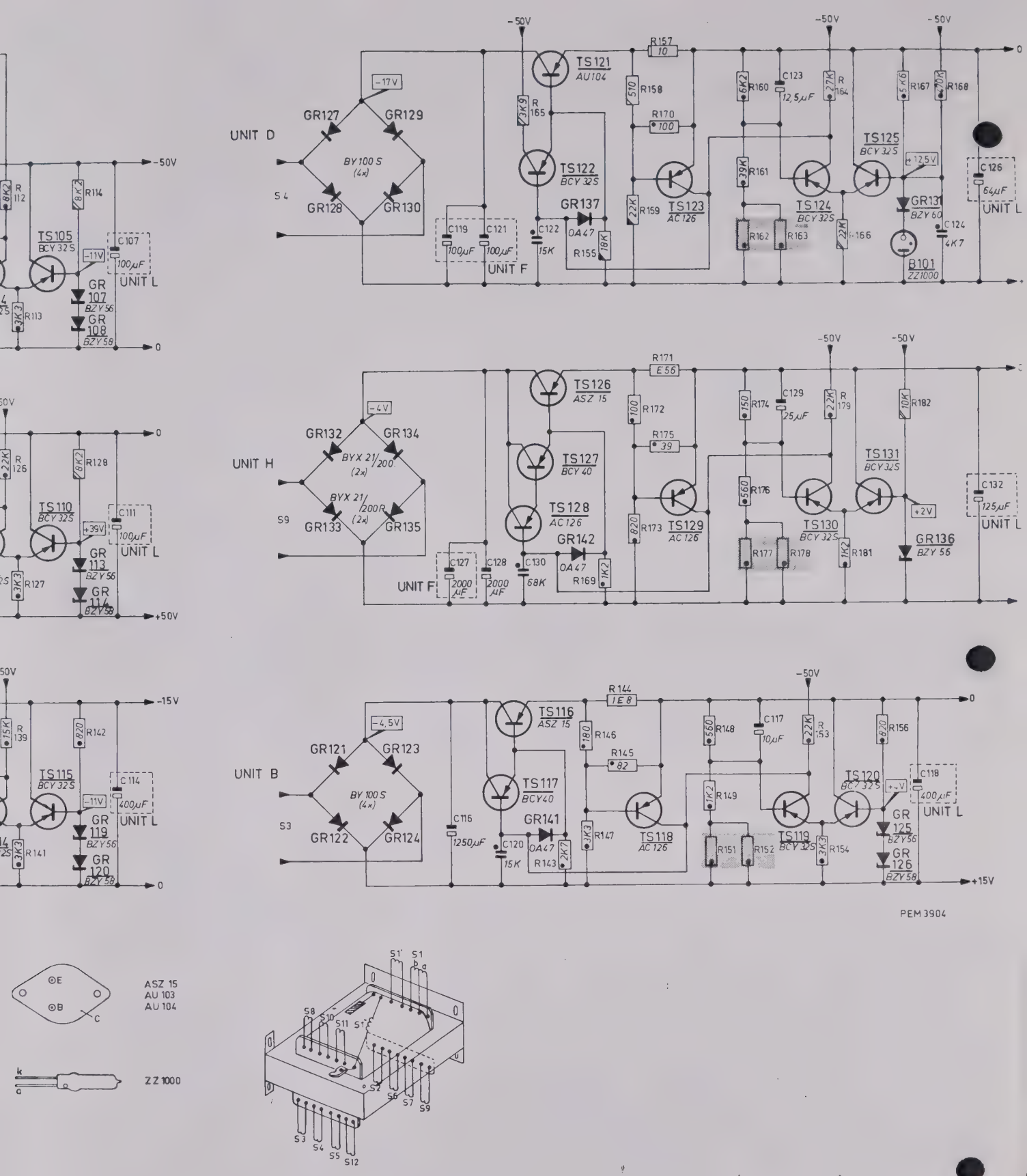

*Fig. 38.*
*Unit J, wiring print plate*




A2 = A18 = B2 = B18 = 0
A17 = B17 = +15 Volt
A19 = B19 = -15 Volt
A20 = B20 = +100 Volt
A21 = B21 = + 50 Volt
A22 = B22 = - 50 Volt
A23 = B20 = + 6,3 Volt
A1 = Bi = 6,3 Volt ~

*Fig. 39. Connections of plugs A and B*


SK4
220V
215V
200V
110V
145V
125V
T3
S1a
S1b
S1
SK4
VL1
VL2
SK1
POWER ON
UNIT G
UNIT E
UNIT C
UNIT F
UNIT L
GR101
BY100S
GR102
BZZ 27
C 101
100µF
C102
80µF
R101
820
-70V
S5
S6
S7
-60V
-15V
-50V
-9V
-20V
GR103
GR104
GR105
GR106
GR109
GR110
GR111
GR112
GR115
GR116
GR117
GR118
BY 100 S
(4x)
TS101
AU 103
TS102
BCY40
TS103
AC 126
TS104
BCY 32S
TS105
BCY 32S
TS106
AU103
TS107
BCY 40
TS108
AC 126
TS109
BCY 32S
TS110
BCY 32S
TS111
ASZ 15
TS112
BCY40
TS113
AC 126
TS114
BCY 32S
TS115
BCY 32S
GR138
GR139
GR140
OA47
R102
R103
5E6
R104
270
R105
100
R106
10K
R107
6K8
R108
1K8
R109
R111
R113
3K3
R114
8K2
R117
R118
560
R119
R120
47
R121
R122
R123
R124
R126
22K
R127
R128
R130
R131
1E8
R132
180
R133
R134
R136
R137
R138
R139
15K
R141
R142
820
C103
500µF
C104
15K
C106
10µF
C107
100µF
C108
500µF
C109
10µF
C110
15K
C111
100µF
C112
1250µF
C113
10µF
C114
400µF
C115
15K
-11V
+39V
GR 107
BZY 56
GR 108
BZY 58
GR 113
BZY 56
GR 114
BZY 58
GR 119
BZY 56
GR 120
BZY 58
S10
LA 1
8034D
BYX 21/200
BYX 21/200R
BY 100 S
BZZ 27
BZY 56
BZY 58
BZY 60
BCY 32
BCY 40
AC 126
ASZ
AU
AU
ZZ







ASZ 15
AU 103
AU 104




ZZ 1000



*Fig. 40. Circuit diagram, supply sectio*

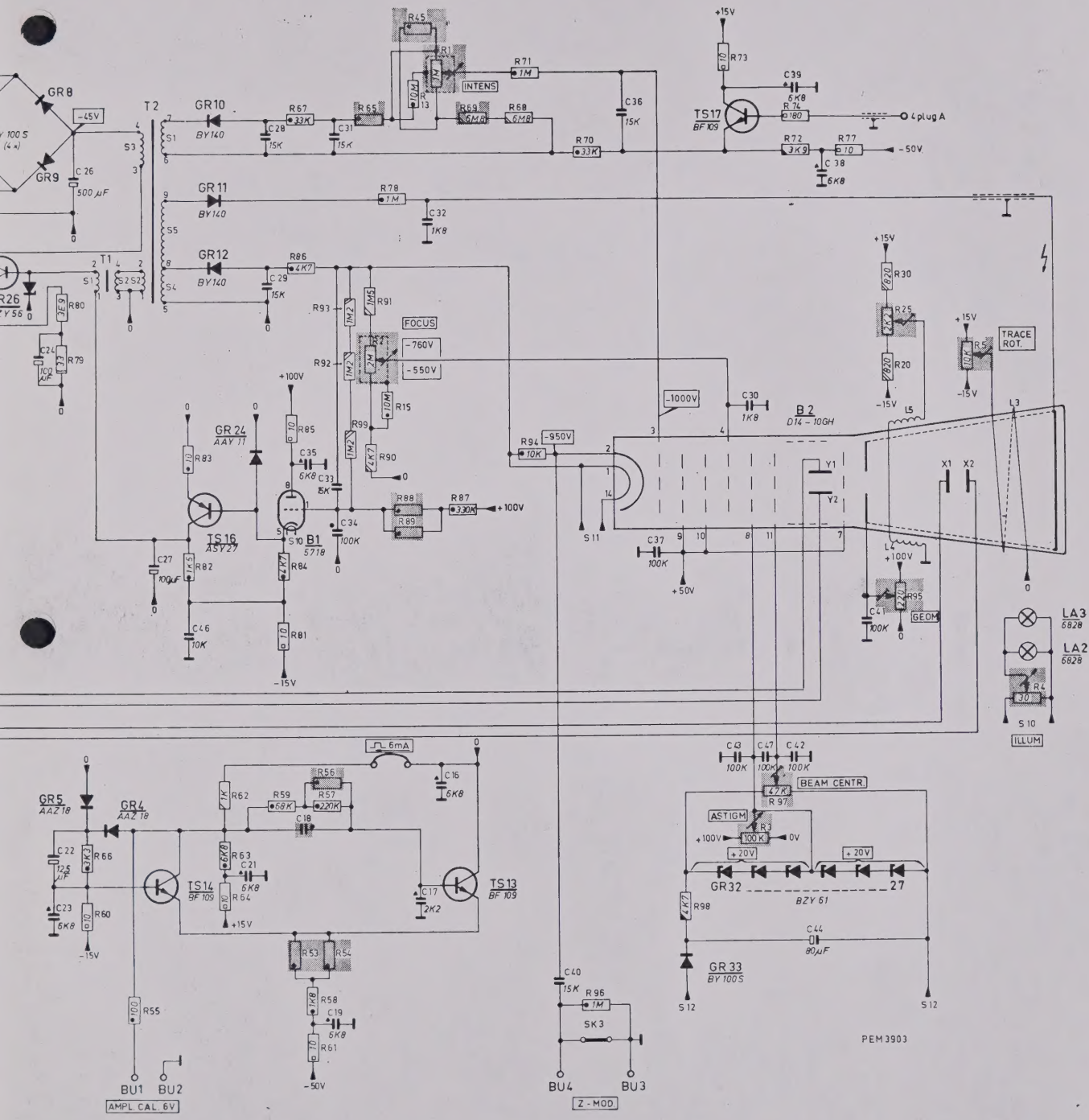
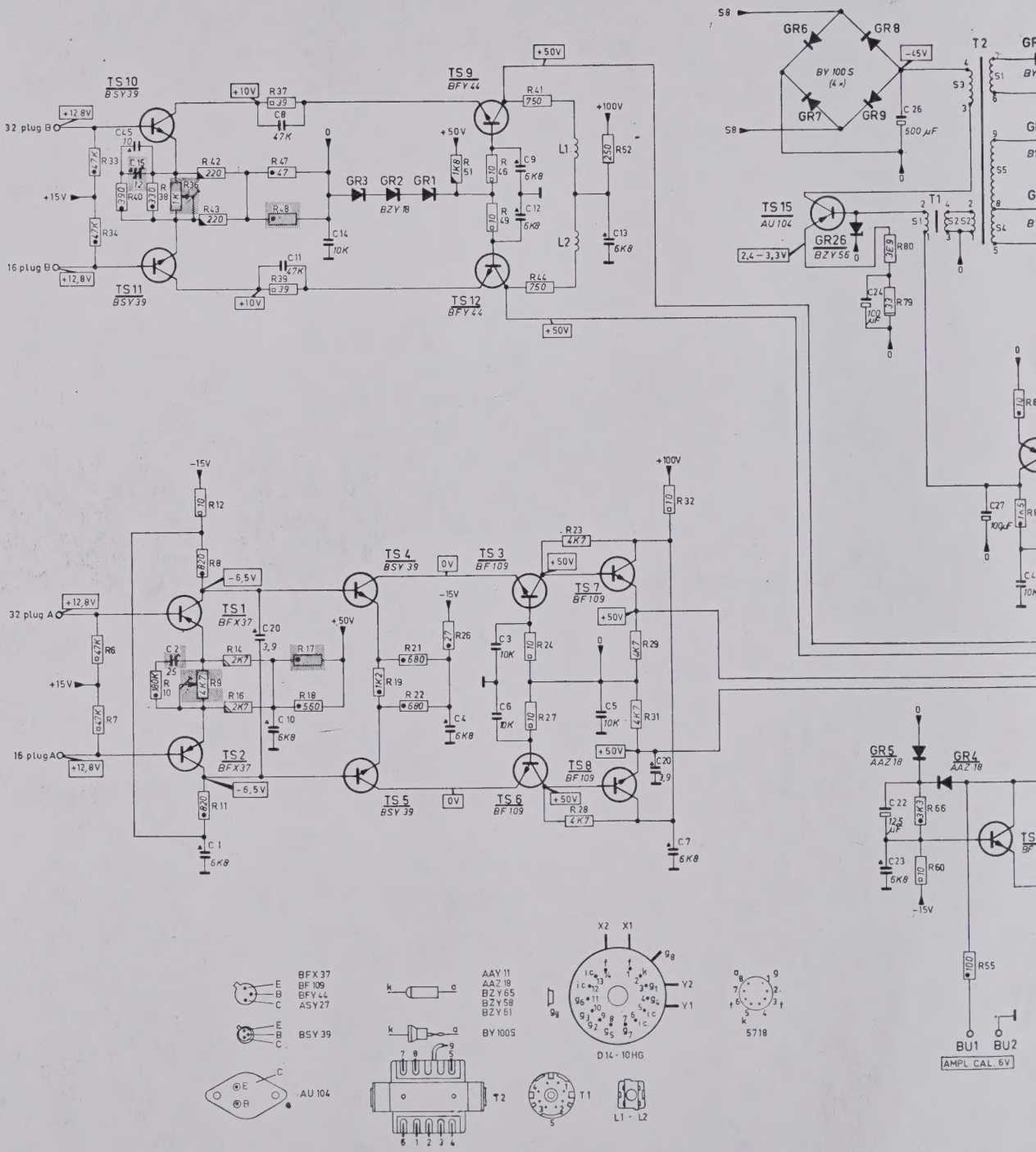
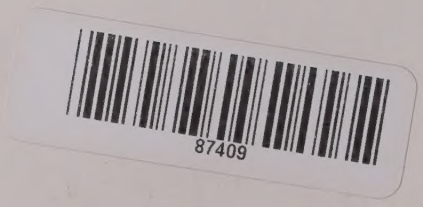



*Fig. 41. Circuit diagram, PM 3410*


TS10 BSY39
TS11 BSY39
TS9 BFY44
TS12 BFY44
TS1 BFX37
TS2 BFX37
TS4 BSY39
TS5 BSY39
TS3 BF109
TS6 BF109
TS7 BF109
TS8 BF109
TS15 AU104
GR26 BZY56
GR1 GR2 GR3 BZY18
GR6 GR8 GR7 GR9 BY100S (4x)
GR5 AAZ18
GR4 AAZ18
T1
T2
L1
L2
+12,8V
+15V
-15V
+50V
+100V
-6,5V
0V
32 plug B
16 plug B
32 plug A
16 plug A
BU1 BU2
AMPL CAL 6V
BFX37 BF109 BFY44 ASY27
BSY39
AU104
AAY11 AAZ18 BZY65 BZY58 BZY61
BY100S
D14-10HG
5718


87409